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THE NEW! 73 Amateur Radio Today

DXpedition: SV8 Mykonos
(cover)

Secrets of:
- Transistors
- Tuners

Kiwi ATV Project

Livin' la Vida Loca(l) In Madrid and Valencia

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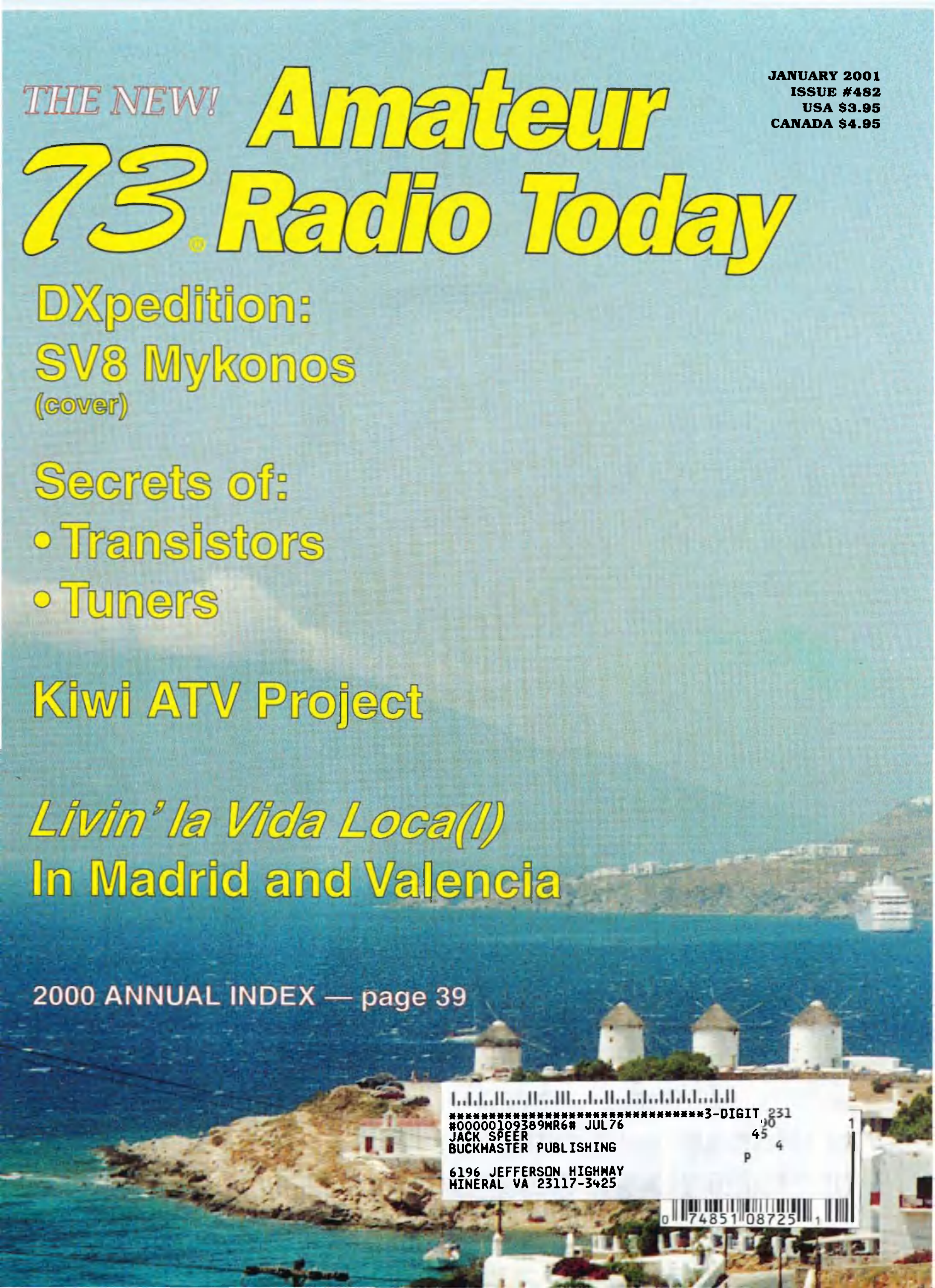

JANUARY 2001
ISSUE #482

THE NEW!

73 Amateur Radio Today

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www.waynegreen.com

QRX . . .

The Law: W6OBB Settles

Retired radio show host Art Bell W6OBB has settled his defamation lawsuit against a radio station and another talk show host. Bell said that both had defamed him.

You may recall that last year talk show host Art Bell W6OBB retired from broadcasting to pursue litigation against those he claimed had defamed him on the air. In his earlier May 1998 court filing, W6OBB charged that on December 9, 1997, one Ted Gunderson had broadcast a radio show transmitted by WWCR. Bell said that during the course of that show a guest by the name of David Hinkson made statements that may have left the listening audience with the belief that Bell had been charged with child molestation.

These statements were false. In fact, Bell claimed that he would carry on his litigation until he was totally vindicated. And it now appears that he was successful.

In an October 20th posting to the *Coast-To-Coast AM* Web site, it was announced that, having received an apology and retraction, Bell had agreed to a settlement which releases Gunderson and the radio station from the legal action. The rest of the terms of the

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Manuscripts: Contributions for possible publication are most welcome. We'll do the best we can to return anything you request, but we assume no responsibility for loss or damage. Payment for submitted articles will be made after publication. Please submit both a disk and a hard copy of your article (IBM (ok) or Mac (preferred) formats), carefully checked drawings and schematics, and the clearest, best focused and lighted photos you can manage. "How to write for 73" guidelines are available on request. US citizens, please include your Social Security number with submitted manuscripts so we can submit it to you know who.

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Number 1 on your Feedback card

NEVER SAY DIE

Wayne Green W2NSD/1
w2nsd@aol.com
www.waynegreen.com

Two Triple Zip

Two triple zip was one helluva ham radio year! The code speed yoke was removed by the FCC, despite every effort of a relay organization which shall remain nameless to retain the car-cranking part of the driver's license exam. This unleashed a flood of Techs on our VEC teams and a bonanza for what had been a badly suffering ham industry.

The timing was perfect. Here we are, right in the middle of one of the best sunspot maximums in radio history, making our ham bands red hot. DX has been pouring through day and night. Six meters has been making new records. It's been a ball.

Now, with February coming up, we're getting into the best time of the year for antenna work. Any pune can put up an antenna in the summer, but it takes a real man to get out there in the snow and freezing weather to put up new antennas. So get busy — order that tower you've been wanting. Get a climbing belt from Bill W2ONV (say hello from Wayne — he'll remember me). Give yourself enough antenna-raising adventures to keep you talking for hours. Maybe you've noticed that I keep writing about the two twin-three beams I put up in ten feet of snow in 1946. Or my 336-element two meter beam up on Mount Monadnock that put a hellacious signal 600 miles down the east coast.

Hey, if you can't find enough listeners to your stories on the air, how about putting 'em into writing for me?

The inrush of Tech upgrades was great for 2000, but soon we'll be back to our most basic problem: attracting teens to our hobby. And I'm not talking about Archie comic books. We need to see the League mount a national PR effort to rebuild the thousands of school radio clubs that were blown away in 1965.

For instance, there are thousands of radio talk shows, all desperately looking for interesting guests to interview. This doesn't cost much to do. Hey, I've been doing my part, talking up the hobby at every opportunity in my talk radio interviews. But we need a dozen or two of us out there doing this.

Yes, You Can Help!

I'd love to have a book available for kids, helping to get them excited about ham radio. Sure, I can regale them with the lifetime of excitement and adventures amateur radio has provided me, but I need your stories, too. Please get busy with your word processor and tell us about the adventures the hobby has provided you. You can't go on DXpeditions via the Internet. Or work seven states on 10 GHz, like I did. Or launch ham-TV cameras from balloons. Or have a ball on Field Day. Or get to personally know people like Barry Goldwater, King Hussein, Jean Shepherd, and Walter Cronkite over the Web. Now, get busy.

DXpeditions 2010

Well, maybe 2020, since I seem to always turn out to be way too optimistic about how quickly new technologies are going to be accepted. Anyway, I want you to sit here and look over my shoulder into my crystal ball and check out what I'm seeing.

The advent of the Kachina, the 100% computer-controlled station, plus the news about $1 Web controller chips got me to start combining these technologies.

Eons ago, in ham years, the more adventurous of us were setting up remote-controlled base stations on mountaintops so we could work out on two meters. This, naturally, led to repeaters, which led to phone patches on the repeaters, which led to the voting receiver system in Chicago, which led to today's cell phone industry.

Now, with the Kachina, we're seeing the more adventurous of us remotely controlling our home stations via the telephone lines. And a few of the even more adventurous interfacing the Kachina home station with the Internet. Okay, now let's suppose that hams in rare countries, tired of being pestered for 30-second QSL contacts, put their Kachina stations on-line so anyone anywhere can fire it up, swing the beam, and tune the band. That's right, an instant DXpedition from anywhere you can access the Internet, and that's getting to be just as easy as we can make HT contacts via our repeaters.

Thirty years ago I set up a Standard repeater in my home shack so I could make DX contacts on 20m via the repeater as I made my morning walks up nearby Pack Monadnock mountain. That sure took the boredom out of my daily exercise. Then I took the repeater (and a suitcase full of HTs) over to Jordan and set up JY73 on top of a hill in Amman, just across from King Hussein's downtown palace, making it possible for all the hams in the area to be in touch.

One of the more exciting contacts of my life was when I was visiting Ray Naughton VK3ATN, in Birchip, Australia, to take pictures of his two-meter moonbounce antenna. I got on the air from his station and had a 5-9 contact with my home station in New Hampshire on 20 meters. Then we tried 75 meters, and I had the thrill of hearing my 5-9 signal on that band, too! Wow!! Now, with the Internet, I'm in daily contact with my ham friends anywhere in the world, so the next relatively small step will be when they interface their stations so I'll be able to get on the air through them from anywhere I can access the Internet. And that's getting to be almost anywhere.

Okay, now let's make all this happen. I want to see you get off your duff and start peppering me with articles on remote basing via the Internet.

73 led the way with 2m FM and repeaters. Now, with your pioneering spirit in gear, let's use *73* to take advantage of the next big step into the future for amateur radio — a marriage with the Internet. Don't just sit there!

How long will it be before we'll be able to work our home station from 100 countries?

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settlement were said to be confidential. The statement adds that Bell is now looking forward to putting this matter behind him and moving on with his life.

No word at press time about whether Bell planned to return to broadcasting on a regular basis. His former show — *Coast-To-Coast AM* — is currently being hosted by Mike Siegel from his home near Seattle WA.

Thanks to Coast-To-Coast AM, *via Don Wilbanks KC5MFA, via* Newsline. *Bill Pasternak WA6ITF, editor.*

Verizon Scrambles to Accommodate Hams

Verizon engineers are working to correct a serious problem with their Internet service, which adversely impacts amateur radio operators. It seems that Verizon's E-mail system was designed to prohibit the use of a number digit in an E-mail address, which effectively prohibits the use of a ham call.

The problem was discovered by Verizon customer James Alderman KF5WT, who signed up for Verizon DSL Internet service at his Dallas home. When James contacted the Verizon corporate offices in Irving TX, Verizon Media Relations spokesman Bill Kula said they were unaware of the problem and its potential impact on the hundreds of thousands of hams in the USA. Certainly they don't want to exclude so many potential customers.

Kula said that Verizon system engineers consider correcting the problem a matter of "highest priority." The system was said to have been originally set up to prohibit a number digit in an E-mail address to avoid possible billing conflicts arising due to similar log-on and alias names in the system.

Although no timetable was given, the issue is expected to be resolved quickly, as we go to press. Any ham wishing to buy Internet service from Verizon, or any other ISP, is urged to specifically inquire as to whether a ham call can be used in an E-mail address.

For more information, contact Verizon at 1225 Corporate Drive, Irving TX 75038, or at (972) 507-5000.

Thanks to James Alderman KF5WT, Carrollton TX.

Photo A. Biloxi Chamber building with 10–40 meter antenna in front.

The Old Biloxi Lighthouse

Thanks to Ernest "Ernie" Oman, Jr., W5OXA/W5B/KP2 for this account of International Lighthouse/Lightship Weekend, last August 19–20:

Well here it is again, August, and the temperature is in the upper 90s and climbing, with a heat index of 110 degrees. I have a truckload of equipment and another old dude like myself to help with putting up the antennas. Kim N5XGI, my old faithful buddy, is always there to help me with these situations that I get myself into.

It did not take too long to put up the antennas, but we would have to work for about 10 minutes and then drink water for half an hour. After all the antennas were installed, we then moved into the building, where the air conditioning, fortunately, worked perfectly. We installed all the equipment and checked out the systems, and they were all within mil specs. Now all we had to do is wait until 0001 UTC and start whaling away.

I took the first shift, and we racked up some 100 contacts. By that time I was so tired, wet, and hungry I took my body home, put it into the shower for an overhaul, and then to bed I went. Saturday I was up at the crack of dawn and off for the usual breakfast at our local greasy spoon with the local hams. Kim followed me to the Biloxi Chamber building (our hosts), and we started again. The bands did not seem to be in very good shape, but the old stand-by was hot: 20 meters.

Later that morning, Randy N5UE, a member of our DX group (The Magnolia DX Assn.), dropped by and volunteered his talents in operating. He hung in there for the remainder of the weekend. Darryl KD5CQT, also of the DX Assn., dropped in and operated for a long time, along with another local ham, Frank WA5GDF. Using four operators and one station by 0251 UTC the 19th, we had racked up 607 QSOs, and we called it quits for the night.

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Photo B. Ernie W5OXA after antenna and equipment installation.

Photo C. Biloxi lighthouse as seen from the porch of the Chamber building.

LETTERS

From the Ham Shack

Jerry Miller W8IDP, Grand Rapids MI. As a long-time reader of *73 Magazine*, I appreciate articles detailing biographies of hams who have led interesting lives and contributed to our hobby.

However, I am puzzled by some of the data in the article on the life of Jim Gray W1XU/7, SK, in the October 2000 concerning his early license requirements.

I am 79 years old and was one of the very first Novice class licensees in the spring of 1951 following the implementation of Docket 9295, which did away with the old Class A and B structure and implemented the new categories of Extra, General, Technician, and Novice.

This change was the stimulus for great controversy among the old-timers. It was a boon to newcomers like myself whose education (biology) was far from the technical side of ham radio. It was my impression that Docket 9295 was implemented in 1950 and was in full force in 1951 when I got my ticket. Therefore, I am puzzled by the statement that Jim had to spend one full year on CW before taking the Class A exam. I'm sure that the old Class A was abolished in 1951. Perhaps you can clear this up.

I was in graduate school at the time and built an 80m CW transmitter from plans in the ARRL manual. Rigs at that time used balanced output with plug-in coils. My antenna was a long length of TV twinlead. I operated as Novice on the low end of 80m for 3 months and then got my General ticket. I got on 80m phone with a surplus BC696 using a 24V power supply for the 1625 tubes. I built a screen voice modulator from plans in the old *Radio News* magazine, and had a barrel of fun. My receiver was a National NC125, which I still have.

I was QRT for many years, and then in the 1970s built several Heathkits and got back on the air on 40m phone. Unfortunately, when computers came along I got hooked and have been off the air for about 12 years — although my Kenwood transceiver remains ready to go on the air anytime. The fun kind of ran out of operating once all the gear got so commercialized.

Anyway, I do enjoy reading your magazine. Keep up the good work.

P.S. Wayne, I first heard you on the air in about 1951-52 when you were living in upstate New York. You were running a Johnson Viking at the time, and used to contact Sam Harris W8UKS, who specialized in 75m DX.

Hey, Jerry: How dare you waste our time complaining about an SK's memory of his licensing history? Don't you have anything better to do than nitpick something like this, when Jim isn't around to defend himself? ... But seriously, *to answer your question, I don't think W1XU/7 was really speaking for posterity when we were talking about his early years, and/or I could have made a mistake in my notes ... In any event, thanks so much for taking the time to write, and for sharing some of your early doings with us. — J.B.*

Louis D'Antuono WA2CBZ, 8802 Ridge Blvd., Brooklyn NY 11209. I'm looking for the *Guide to Surplus* once published by *73*. Can anybody help?

David Brittenham WAØRVK, Monett MO. It's been almost 30 years since I last wrote you, maybe even longer. I was a very young teen at that time, only licensed a couple of years, and had some stupid idea that I wrote you about. Anyway, that's history, just wanted to see if you remembered me! No? Well, I guess I wasn't that interesting then, huh?

I'm simply writing to let you know that through all those years, I've read nearly all of your editorials, having been a subscriber since late in '67, shortly after receiving my license at the age of 12. While I won't go so far as to say you have been my hero or idol, I DID want to say that you have been my inspiration in many endeavors. Your constant harping at your readers to be better than they currently were had an effect on me. I can't say that I've reached all my potential through all those years, but I CAN say that without some of the prodding from your editorials, I would be less today than I am.

Why am I writing now? Simply to say, "Thank you," for having written the words that got me to thinking about what I wanted to do with my life, to get me to BE something, other than just another factory worker. And for writing the words that KEPT me going, getting me interested in microprocessors, repeaters, etc. I learned most of what I know about electronics from *73 Magazine* back in my jr. high and high school days, sitting in French class, with the (then small-sized) magazine tucked into the textbook. I learned a LOT in that French class, just nothing about French! Same with English grammar. Same with literature. I did pay attention in history, science, and math classes, though!

I never went to college, although I had a full scholarship to the state university. But, I earn more today than any of those other 27 students that graduated with me, including those who went on to college. How did I do it? I read *73 Magazine!*

Thanks again, and maybe I'll write you in another 30 years.

Mark Nelson AA8PS. The best buy I've ever made was my life subscription to *73 Magazine!* I really enjoy your editorials. Everyone else seems convinced that technology either has or will have the answer to all of mankind's problems. It is refreshing to hear from someone with practical suggestions about how we can do something to improve our own lives rather than pay someone else to do it for us. As I've read your editorials mentioning fluoride in our water, I can't help but wonder about the fluoride in toothpaste and mouthwash as well. I'd love to read in one of your editorials of any practical alternatives.

Fluorided toothpaste has killed children who swallowed it. Avoid this poison! It's the brushing that cleans your teeth, not the toothpaste. If you feel the need for something, use plain old salt. — Wayne.

Elmer Sinclair KD4JUH, New Milford CT. Wayne, congratulations on your 78th birthday, the day on which you completed your 78th year. At this time two years hence, when you will be 80, you will have completed the seventh decade of your life.

So it puzzles me that you believe we are now in the first year of the 21st Century. This belief and your acceptance of the fact that there was no "year zero" are inconsistent. Centuries always begin with a year _ _ 01 and end with the completion of a year _ _ 00. I believe this computer age is partially responsible for the confusion; i.e., a decade counter counts from zero to nine.

You remind me of my dear departed wife, whose favorite remark was "I don't care what anybody says!" I admire the spunk, but that is a dangerous philosophy.

Regards from a "barn-dusty" friend. 73

Cabbage: A ... vegetable about as large and wise as a man's head. *Ambrose Bierce* (1842-1914)

Phil Whitchurch G3SWH
21 Dickensons Grove
Congresbury, Bristol
BS49 5HQ United Kingdom

SV8 from the Geranium

Mykonos is a great DXpedition — once you get there.

I am beginning to think that I carry some sort of a curse as far as air travel to Mykonos is concerned. Or is it just that charter airlines are cursed? In 1997, the airline incorrectly labeled the baggage, and the transceiver almost went to Santorini. In 1998, the 8-meter-high telescopic antenna mast failed to arrive. What could go wrong in 1999?

Mykonos is one of the Cyclades group of Greek islands in the Aegean Sea, about 100 miles east of Athens. The word "Cyclades" derives from the classical Greek "cyklos," meaning circle, and the islands are so named because they form a circle around the sacred island of Delos, the mythical birthplace of Apollo and Artemis. According to legend, Mykonos is the rock which Poseidon used to batter-in the skulls of some giants he found irritating. About 29 square miles in area, the guidebooks describe it as dry and barren, with sandy beaches and dynamic nightlife — Greece's glitziest (and probably most expensive) island. It used to be widely known as the gay center of the Mediterranean, a title more recently lost to places like Ibiza and Sitges in Spain.

Photo A. Tales of the island's beauty are not unfounded.

From the radio point of view, Mykonos is part of Greece as far as DXCC is concerned, and counts as EU-067 for IOTA purposes. Licensing is simple — under the CEPT Recommendation T/R 61-01, which Greece has implemented, all that is required is to prefix my own callsign with the appropriate host country prefix. Thus, I become SV8/G3SWH when operating in Mykonos. Greece is a European Union member country, so there are no customs problems to worry about either. It can be interesting passing through airport security checks, though, and a good idea to carry your home station license with you at all times.

My wife, Jan, and I have been taking holidays there since 1980. Our two children used to come with us until they got old enough to do their own thing, but this year my son Mark and his girlfriend Janet joined us. It was to be Mark's first visit after a ten-year gap.

We took off on time at 7:00 a.m. on 16 June, with an expected arrival on the island of 1:00 p.m. local time. All appeared to be going swimmingly until we were 1-1/2 hours into the flight, when the captain announced that he had suffered a failure of one of the three hydraulic systems on the A320

Airbus, and that we were returning to London's Gatwick airport for repairs. Amid loud collective groans, he explained he really had no option. Gatwick is the only place equipped to repair his company's aircraft. The alternative of carrying on to Mykonos probably meant the aircraft being stranded there with no repair facilities at all, not to mention a planeload of frustrated returning holiday makers.

We arrived back at Gatwick at around 10:00 a.m., the fault quickly diagnosed as a failed "O"-ring seal, and repairs immediately put in hand. Initially, passengers were asked to wait on board as the repair would not take long. It was a hot day, the aircraft ventilation system had to be shut down, and many passengers were suffering nicotine withdrawal. Thus, after a short while, we were all taken, complete with all hand luggage, back to the terminal building, having been assured of drinks and (for those in need) a smoke. You can imagine the general response when we were ushered into a non-smoking transit area with a drinks machine which was out of order!

The aircraft was repaired in a little over two hours, and we reboarded at about 12:30 p.m. The original crew had been replaced with a fresh one by this time, as the original had exceeded their permitted working hours. The new captain announced he had an air traffic control slot for 1:30 p.m. The ventilation system was now working, and I settled down for a sleep, having left home in Bristol at 1:30 a.m. to drive to Gatwick.

Engines were started on time, and we joined the queue of aircraft on the taxiway. We were next in line for take off when one of the passengers got up from his seat and tried to open the doors, saying he had to get off, as he had chest pains. The crew asked if there was a doctor or paramedic on board. Fortunately, a cardiologist came forward and recommended the passenger go to hospital. We returned to the departure gate. Paramedics came aboard, and the poor fellow was whisked off in an ambulance with his two traveling companions. All their baggage stayed on the aircraft.

Photo B. Mykonos is famous for its windmills (center bottom in Photo A).

We then had to wait for another air traffic control slot, and it was not until 2:30 p.m. that we eventually took off. Apart from a free drink from the airline to compensate us for our troubles, and a second airline meal, the flight was uneventful. We finally arrived in Mykonos at around 8:00 p.m. Amazingly, all our baggage arrived safely.

About the first person we saw was Anagyros, an old friend who runs the Hotel Drafaki, where we had stayed in 1994. He very kindly offered us a lift down the hill to the Geranium Apartments, where we have stayed for the past five years. We arrived just in time to watch the spectacular sunset. Paris, our tolerant and long suffering landlord, was there to greet us, to proudly show us his recently completed swimming pool, and to bring us up to date with all the gossip. We were duly installed in two adjacent rooms, with Jan and I in our usual, #21 on the first floor, which has a balcony with wonderful view of the sea to the south and west.

We first discovered the Geranium during our visit in 1994, whilst exploring. Located on the top of a hill, some 600 feet above sea level and overlooking the town itself, it is a superb radio

Photo C. The Geranium Apartments.

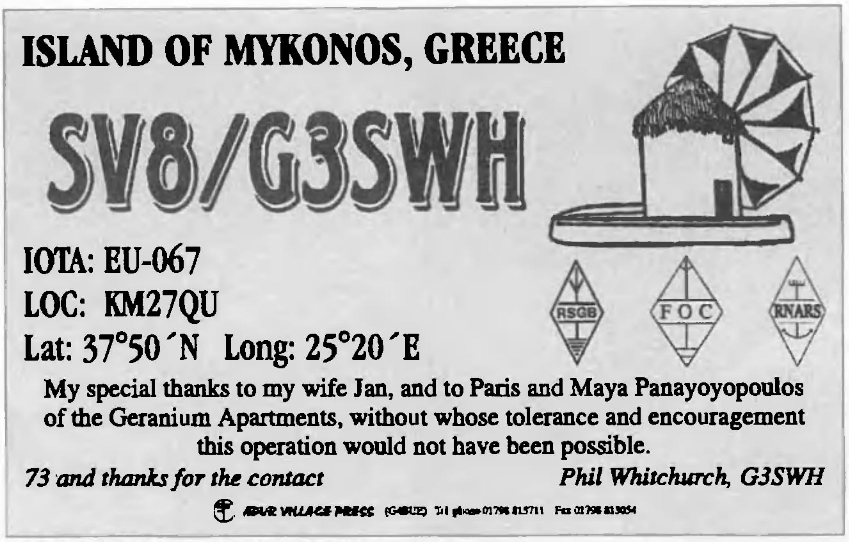

Fig. 1. QSL card from the island of Mykonos, Greece.

QTH, with a clear takeoff over water to the south, east, and west. The take-off to the north is less satisfactory, but the land is generally flat.

A quick shower and change of clothes, and we were off into town for dinner and to show Mark and Janet a few of the sights. Mykonos town itself is a tangle of narrow lanes and alleyways; originally designed to confuse attacking pirates, the plan still works on the tourists of today! Dazzlingly white, cube-shaped houses with blue-painted shutters climb up the hill from the bustling, much photographed harbor. Bars, tavernas, discos, hotels, and restaurants line the streets in glorious profusion, but it was an early night for us, in Mykonos terms — about midnight.

When we first visited in 1980, the only way was to get a night charter flight from Gatwick or Luton airports to Athens and then take an early morning ferry from Piraeus, which took about seven hours and called at Syros and Tinos en route. The outgoing journey took a total of something like 16 hours, and the return about 22 hours, so you really had to want to go!

As tourism has developed, Olympic Airways has introduced domestic flights from Athens to the island, but these are prone to cancellation at short notice due to bad weather, which gives potential problems in catching the Athens/London flight home. Direct flights were introduced by a variety of charter airlines using Boeing 737 aircraft. The island's runway is quite short, and the aircraft had to get on the ground within about the first five yards or go around again. It never happened to me!

There was always talk on the island of extending the runway, but the plans involved demolishing an inconveniently sited church and had been stalled for years whilst delicate negotiations were conducted. About three years ago, agreement was finally reached and construction completed over the winter.

I first took a radio with me in 1995, which was the first year we stayed at the Geranium Apartments. Jan was not entirely happy about me playing radio whilst on holiday, but I persuaded her to give it a try with the promise that it would not take over from spending time together. That year, I carried as hand luggage my main station radio — a Yaesu FT-101ZD, which weighs some 44 pounds — and made 743 CW QSOs, including 8 "dupes," with 53 DXCC entities (or was it countries in those days?), in about 13 hours of operating. On-the-air activity was restricted to an hour or so in the mornings whilst Jan was sleeping, and an hour in the late afternoons between returning from the beach and going out for dinner. It is a formula which has worked well for us, both in Greece and other places.

In 1996, I tried to borrow a lighter radio from various friends, but nothing was available, so once again I carried the FT-101ZD as hand luggage. I followed the same operating hours formula and made 1221 CW QSOs, including 53 "dupes," with 54 DXCC entities in about 21 hours of operating. This brought the DXCC score for both years up to 64.

In 1997, the IOTA Committee made one of their Yaesu FT-900AT transceivers available to me. It comes in a

Photo D. Things didn't change much from 1995 (left) to 1998 (middle) to 1999.

beautiful, molded, reinforced, and padlocked carrying case, slightly too large to carry as hand luggage but quite suitable for going in an aircraft's hold. This was the year that the airline mislabeled our baggage and I had to personally retrieve the transceiver from the aircraft hold whilst it stood on the tarmac in Mykonos before going on to Santorini. Eighteen and a half hours operating under improved conditions produced 1164 CW QSOs, including 29 "dupes," with 56 DXCC entities, bringing the three-year total up to 71.

In 1998, I bought a secondhand Icom IC-706 MK I and put together a complete 100 watt HF station in a small suitcase capable of being stowed in an overhead locker. It still weighed about 40 pounds, though! That year, I operated for 24 hours in total and made 1665 CW QSOs and (amazingly) no "dupes," with 65 DXCC entities, improving the all-time total to 83.

I added a secondhand laptop later that year, and 1999's activity had real-time computer logging using CT in DXpedition mode. There were definitely no "dupes" in this year's log! Twenty-four and a half hours of operating produced 1636 CW QSOs with 66 DXCC entities, making a grand total of 92.

Year	Band							Total	DXCC in year	DXCC all-time
	7.0	10.1	14.0	18.1	21.0	24.9	28.0			
1995	74	432	124	113	0	0	0	743	53	53
1996	66	114	786	254	1	0	0	1221	54	64
1997	15	178	394	410	33	134	0	1164	56	71
1998	3	164	737	625	104	32	0	1665	65	83
1999	1	17	123	766	374	352	3	1636	66	92
Totals	159	905	2164	2168	512	518	3	6429	--	--

Table 1. Contacts summary.

Back to our story: Last year, after our early night and a well-earned rest, the first job the following morning was to get the antennas rigged. I've always favored a combination of inverted vee wire dipoles for 3.5, 7.0, 10.1, 14.0, and 18.1 MHz on a common coaxial feeder for such operations. 21.0, 24.9, and 28.0 MHz seem to load quite happily via an MFJ-901B ATU and the whole setup gives good results. In previous years, the center of the antenna has been supported on a short bamboo pole lashed to the chimney of the building, and involved climbing a rickety ladder onto its flat roof. This year, the telescopic mast survived the baggage handlers' best endeavors and I was able to get the antenna much higher than in previous years without risking life and limb. Mark was a great help in getting ready, but a lady resident of the apartments insisted in riding her motorcycle over the wires whilst they were laid out on the ground, and getting them tangled round her front wheel.

There was pressure from the others to get down to the beach, so it was not until late afternoon that I was able to set up the radio on the balcony and make the first QSO with OK1NR at 1448 UTC on 21 MHz CW — a full 24 hours later than intended. Experience has taught me that the balcony is the best place to operate from, preferably helped by a large vodka and tonic. The downside to this is that I have to set up and dismantle the station at the start and end of each session, but this can be achieved in less than five minutes.

A preliminary session of just over 90 minutes produced 131 QSOs. Things

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Hugh Wells W6WTU
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Manhattan Beach CA 90266-4025

Inside Digital TV/VCR Tuners

Part 5: Decimal-to-binary conversion program.

The four previous sections have discussed the tuner types, a data transmitter, a data receiver, and methods for controlling and testing the digital tuner. It sometimes seems that getting ready to do a project takes longer than actually doing the "work" on it, and working with digital tuners is no exception to the rule.

When it comes to communication with a digital tuner, we must use a language that is understood by the tuner, and that includes the format of the data presented. That brings us to the objective of the BASIC program that's discussed here. We, as hams, deal with frequencies in a decimal number format, but the digital tuner can only handle information in a binary format. Therefore, it is necessary for us to convert from decimal numbers to the equivalent in binary.

Converting numbers from decimal to binary is quite easy and may be done using pencil and paper as was discussed in part four of this series. But for those who would rather let the computer do the "work," then the BASIC program shown here will do that and will provide the data in the correct binary format as shown in **Fig. 1**. **Fig. 2** shows the data flow pattern of the BASIC program with decision points. The program generates and formats the data that can be entered directly into the tuner with the data transmitter switches.

The conversion process is done by sequencing a series of subtraction steps and assigning a "1" or a "0" to each, depending upon the success of the subtraction. As the program runs, ones and zeroes are assigned to number variables and stored until the end of the conversion process. The steps in the process start with determining the desired frequency of the tuner's VCO (local oscillator). Entering either the desired oscillator frequency or the desired receiver input frequency finds the other frequency by calculation. An intermediate frequency (IF) of 47 MHz has been used in the calculation. Although 47 MHz is the frequency that I've chosen to use, TV and VCR systems use approximately 43 MHz (midpoint between 41.25 and 45.75 MHz). Actually, the tuner doesn't care about the specific IF that's chosen, and any IF frequency between 41 and 50 MHz can be accommodated at the tuner's output.

The second step in the calculation process is to divide the VCO frequency by the synthesizer step frequency, which is 62.5 kHz for most digital tuners. The result of the division is a number representing the synthesizer divide ratio that's needed by the synthesizer to "lock" the VCO to the desired frequency.

The third step in the calculation process is to convert the divide ratio from a decimal to a binary format that can be clocked serially into the digital tuner's register.

Upon completion of the calculation and conversion, the program will display the original decimal frequency information along with the formatted binary data that will set up the main frequency divider for the tuner's frequency synthesizer.

For simplicity, printout of the final data has been formatted for display on the monitor in preference to a paper printout.

MSD																		LSD
4	3	2	1	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Band Selectors				Frequency Select Data in a Binary Format														

Fig. 1. Data format required for controlling a digital TV/VCR tuner.

The program

The BASIC program shown in **Fig. 3** is divided into four main parts, with

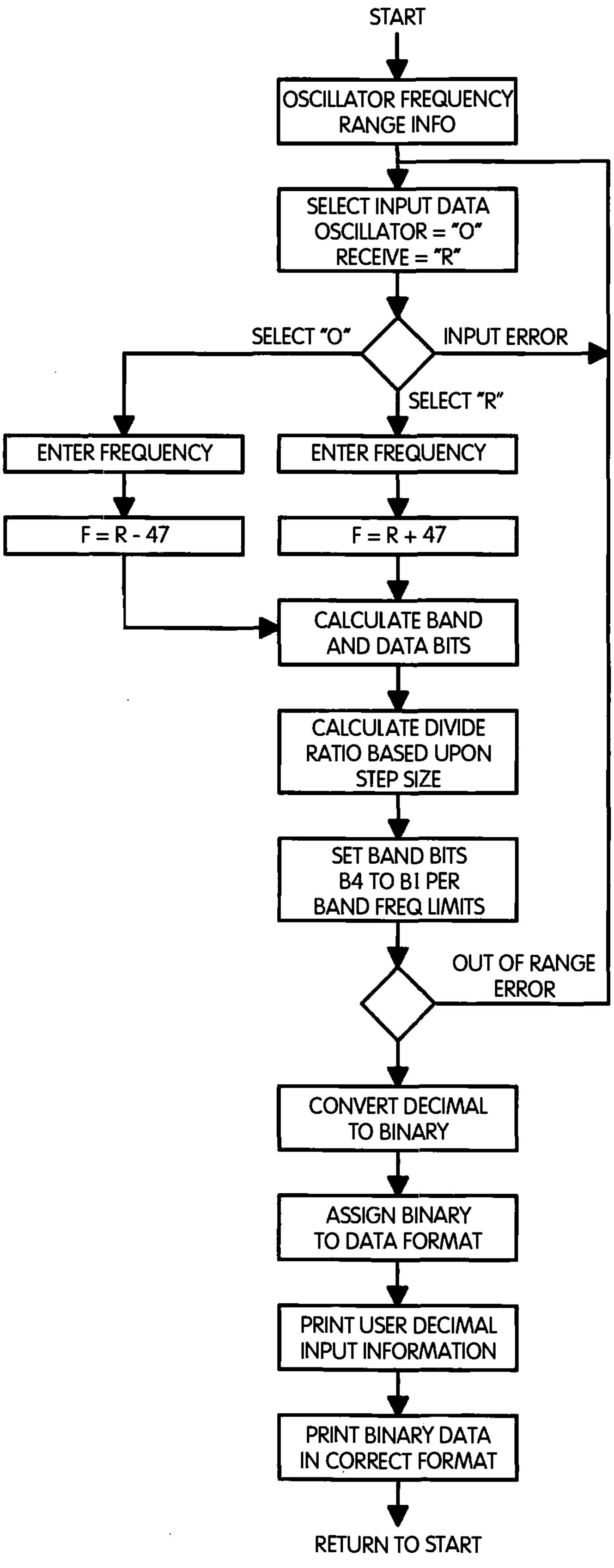

Fig. 2. Flow diagram for a BASIC program that converts decimal frequency numbers to binary and prints data in a digital tuner's required format.

the first being the user interface and input. The second part sets the four band select bits into a binary format. Band bits, as used by the tuner, are not binary, but are "pass-through" one-out-of-four data bits, meaning that the bits represent which synthesizer output band port is to be selected.

The third section of the program performs decimal-to-binary conversion of the divider ratio by a sequence of subtractions and makes the assignment of binary numbers to the number variables. The last section formats the data for display on the monitor.

When I laid out my data transmitter, I used three 8-switch dip switches making for a maximum of 24 binary data entry possibilities. However, the digital tuner can use only 19 of the 24 switches. In an attempt to keep things positioned correctly for minimum data entry into the data transmitter, the binary printout is formatted with the four band bits shown on the left followed by the 15 main frequency divider bits. Spacing is provided between the switch groupings to aid user readability by matching the three blocks of switches. Because of the two-digit offset between the data transmitter switches and the tuner's register, adjusting the placement of the data bit pattern on the transmitter switches is required.

The BASIC code that's used in the program has been done in the most general format possible so that it is suitable for most all BASIC interpreters. Very little conversion of the program lines should be required for it to operate on even the most difficult of BASIC interpreters.

Program changes

There are always changes to be made, so as you work with digital tuners, changes in the way the program presents data will occur. One of the anticipated changes is the step frequency of the synthesizer that you might encounter. As used in TVs and VCRs, the step frequency is 62.5 kHz and is used as such in program line 110. When the tuner can be reprogrammed to operate on a different step

```
10 DIM A$(1)
20 REM 3-WIRE DIGITAL TUNER BINARY CONVERSION PROGRAM
30 REM WRITTEN BY HUGH WELLS W6WTU 9/99
40 PRINT:PRINT:PRINT "TUNABLE RANGE OF THE OSCILLATOR IS": PRINT "96 TO 863 MHZ."
50 PRINT PRINT "ENTER THE OSCILLATOR OR RECEIVE FREQUENCY IN MHZ."
60 PRINT:PRINT "ENTER (O) FOR OSC OR (R) FOR RECEIVE...";:INPUT A$
70 IF A$="O" THEN PRINT PRINT "ENTER OSC FREQ...";:INPUT F:R=F-47:GOTO 100
80 IF A$="R" THEN PRINT:PRINT "ENTER RECEIVE FREQ...";:INPUT R:F=R+47:GOTO 100
90 GOTO 50: REM WRONG ENTRY
100 REM CALCULATE BAND AND DATA BITS
110 N=F/0.0625:REM SETS STEP FREQUENCY
120 IF F<=160 THEN B4=0:B3=0:B2=1:B1=0:GOTO 150:REM VHF LOW
130 IF F<=384 THEN B4=0:B3=0:B2=0:B1=1:GOTO 150:REM VHF HIGH
140 IF F<=864 THEN B4=0:B3=1:B2=0:B1=0:GOTO 150:REM UHF
150 IF F<96 OR F>863 THEN GOTO 50:REM VCO OUT OF RANGE CHECK
160 IF N>16384 THEN 180
170 N14=0:GOTO 190
180 N14=1:N=N-16384
190 IF N>8192 THEN 210
200 N13=0:GOTO 220
210 N13=1:N=N-8192
220 IF N>4096 THEN 240
230 N12=0:GOTO 250
240 N12=1:N=N-4096
250 IF N>2048 THEN 270
260 N11=0:GOTO 280
270 N11=1:N=N-2048
280 IF N>1024 THEN 300
290 N10=0:GOTO 310
300 N10=1:N=N-1024
310 IF N>512 THEN 330
320 N9=0:GOTO 340
330 N9=1:N=N-512
340 IF N>256 THEN 360
350 N8=0:GOTO 370
360 N8=1:N=N-256
370 IF N>128 THEN 390
380 N7=0:GOTO 400
390 N7=1:N=N-128
400 IF N>64 THEN 420
410 N6=0:GOTO 430
420 N6=1:N=N-64
430 IF N>32 THEN 450
440 N5=0:GOTO 460
450 N5=1:N=N-32
460 IF N>16 THEN 480
470 N4=0:GOTO 490
480 N4=1:N=N-16
490 IF N>8 THEN 510
500 N3=0:GOTO 520
510 N3=1:N=N-8
520 IF N>4 THEN 540
530 N2=0:GOTO 550
540 N2=1:N=N-4
550 IF N>2 THEN 570
560 N1=0:GOTO 580
570 N1=1:N=N-2
580 IF N>1 THEN 600
590 N0=0:GOTO 610
600 N0=1
610 PRINT:PRINT:PRINT
"OSC F = ";F;" MHZ","REC F
= ";R;" MHZ"
620 PRINT B4;B3;B2;B1;
630 PRINT
N14;N13;N12;N11;"
";N10;N9;N8;N7;N6;N5;N4;N3;"
";N2;N1;N0
640 PRINT PRINT
650 RUN
```

Fig. 3. *BASIC program that generates and formats the required data for controlling a TV/VCR tuner.*

value, the step number in line 110 can be changed to accommodate the new step frequency.

Also, I've used an intermediate frequency (IF) of 47 MHz when working with TV/VCR tuners because I've found that frequency to be interfered with less in my local area than perhaps 45 to 46 MHz. The actual center IF frequency for tuners is approximately 43 MHz. Because of the wide bandwidth of the tuner's output resonator, most any receiver tuned to the IF between 41 and 50 MHz should work well. But should the calculation of an IF other than 47 MHz be desired, program lines 70 and 80 may be changed accordingly.

Another possible change is the band bit selection based upon the band of frequencies. The tuner designer has the freedom to choose which of the band bits that he may use for whichever band that is to be turned on. As a result, the band select bits may end up not being in a logical sequence. Program lines 120 through 140 may be changed as desired to provide the band data for the tuner being controlled.

When considering changes to the BASIC program, you should refer to the flow diagram as a reference for where the changes need to be made. The flow diagram provides an overall map of the processes and adding or changing details within the program should "fit" into the map.

Parts six and seven, the last in this series, will discuss a simple process for making printed circuit boards for the data transmitter and data receiver that I used for controlling digital tuners during the study. 73

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Transistor Bias: The Secret Story

Shore up some of your shaky transistor theory by taking this tutorial.

Bias means different things to different folks. To electronics geeks, it means a steady voltage or current applied to an electrode. The bias sets the operating point, the quiescent point, for a vacuum tube or transistor. The bias applied to a device depends on the application, but it is usually set for linear operation.

Occasionally a device may need to be biased to some other point. For example, a class B stage is biased at or near cutoff and a class C amplifier is biased well beyond cutoff.

Bias comes in two flavors: fixed bias and self-bias. With fixed bias, the operating point is set arbitrarily or in accordance with conditions given in data sheets. Data sheets are available from the manufacturer or the distributor.

Two different transistors of the same type might have different h_{FE} and their collector currents would be different with fixed bias. Self-bias is a form of negative feedback in which the bias varies with the way the device operates. While the feedback is seldom large, every little bit helps to stabilize the operating point.

The desired operating point can be determined from the data sheets for a transistor or tube. The data sheet often gives a set of curves that show the relationship between the currents that exist in the device and the controlling current or voltage. Data sheets may just list the output current for various operating conditions but they don't tell you how to set the operating point. That's for you to figure out, and this article tells you how.

In lieu of more specific information from the data sheets on how to operate the device, an understanding of the device will allow you to wing it. Cut-and-try designs are sometimes unavoidable when you want to operate at some point other than what is listed. Some simple tests can give you a starting point.

If a tube or transistor is to have a linear relationship between input and output, the bias point should be chosen to place the operating point in the most linear region of the transfer characteristics. Obviously that's somewhere between cutoff and saturation, but you would like to be a little closer than that. Saturation occurs when an increase in the input does not result in an increase in the output. Cutoff occurs when a change in the input does not cause a change in the output. For junction transistors, saturation occurs when the base-emitter junction is forward-biased and the collector-to-emitter voltage is less than 0.6 V.

The collector current in a bipolar transistor, either NPN or PNP, is proportional to the base current. Since bipolar transistors are current-controlled devices, voltages are seldom shown except as limits. The difference between an NPN and a PNP is the polarity of the voltages applied and the direction of current flow. The base-emitter voltage is practically constant at about 0.6 or 0.7 volts for conducting silicon transistors and about half that for germaniums. That's a bit of information that isn't even mentioned in the data sheets. I guess the manufacturers expect everybody to know that. So now you know.

The bias provides a DC current to the base of a transistor and sets the DC operating conditions. The resistance r_b looking into the base of a common emitter stage is in the range of a thousand ohms, and is the resistance that the signal source must drive. However, when the collector current is a fraction of a mil, the base resistance is higher.

The input resistance r_e looking into the emitter of a common base amplifier is even lower, in the range of a few ohms. The bias effects are the same whether the device is operated common emitter, common base, or common collector. Collector current is proportional to base current, and the base-emitter voltage is about 0.6 V or 0.7 V.

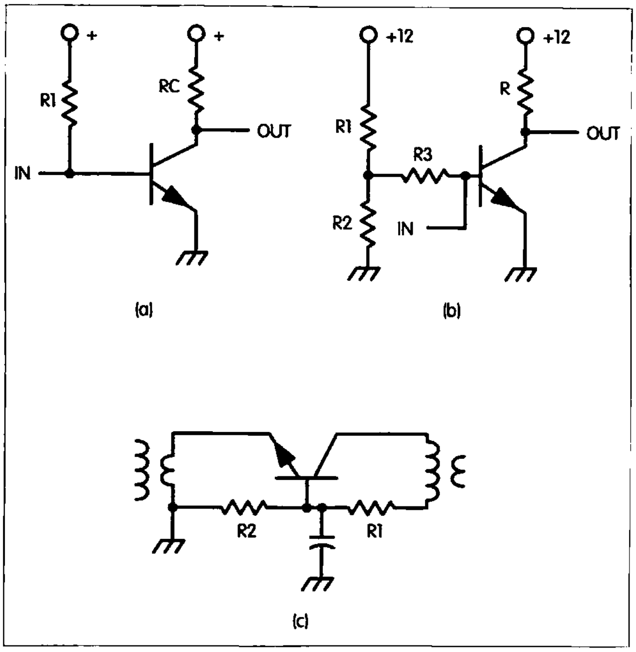

Fig. 1. (a) A common-emitter amplifier can have fixed bias. (b) A common-base amplifier can have fixed bias. (c) A low resistance bias source is required when I_{CBO} is high.

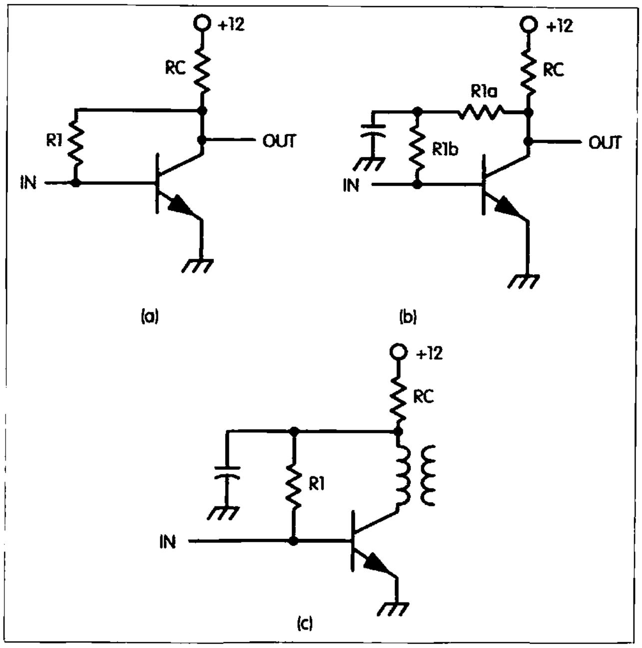

Fig. 2. (a) A common-emitter can be self-biased. (b) Degeneration of AC in self-bias can be eliminated. (c) Self-bias can be obtained with a low DC resistance transformer in the collector.

The DC operation of small transistors is quite similar, even though the AC or RF performance is quite different. Therefore, biasing considerations are the same. For example, the data sheets of the 2N3904, a small general purpose silicon BJT, lists h_{FE} as 100 to 300 when I_C is 10 mA, and 70 minimum when I_C is 1 mA, and 60 minimum when I_C is 50 mA. From these values, it can be inferred that base current will be less than 0.1 mA for 10 mA of collector current, 14 µA for 1 mA of collector current, and 0.83 mA for 50 mA of collector current. This wide variation in h_{FE} implies that the required bias is also not known precisely. Even so, the published information is a starting place. If the h_{FE} is known from measurements, bias currents are known. Otherwise, make a guess from what's given. A procedure for establishing the h_{FE} of BJTs and V_{GS} for JFETs is described later. For the moment, assume that the h_{FE} is known.

Fig. 1 shows a 2N3904 with fixed bias. Ten milliamps of collector current requires less than 0.1 mA of base current. Bias current I_B is provided by R1 and R1= (12 - 0.6)/I_B. When the supply is 12 V and I_B is 0.1 mA, R1 is about 114 k. Because h_{FE} is probably greater than 100, 120 k would be a good starting point.

At high temperatures, I_{CBO}, the collector-to-base current with the emitter open, can be a problem when the bias resistor is high. Silicon transistors have low I_{CBO}, and present no problems except at high temperatures. That is not the case with germaniums.

Limiting bias resistors to a few tens of thousands of ohms for silicon transistors reduces changes in bias with I_{CBO}. An extreme example is a divider of 47 k and 620 Ω from 12 V. The divider will provide 0.1 mA of bias current and I_{CBO} can be ignored. But, the 620 Ω will severely load the signal source. There are alternatives that produce the desired bias current from an acceptably low source resistance.

The resistance of the bias source can be reduced by using a resistive divider to obtain the bias voltage. For example, in **Fig. 1(b)**, a divider, say 3.9 k and 20 k, produces 1.9 V from 12 volts with an internal resistance of $(3.9^{-1} + 20^{-1})^{-1}$ = 3.2 k. To provide 0.1 mA to the 0.6 V base from a 1.9 V source requires a resistance of 13 k..Therefore, an additional series resistance of about 10 k is required. The resistance that loads the signal source is about 13 k in parallel with the base resistance of the transistor r_b. Resistance r_b is in the

Continued on page 20

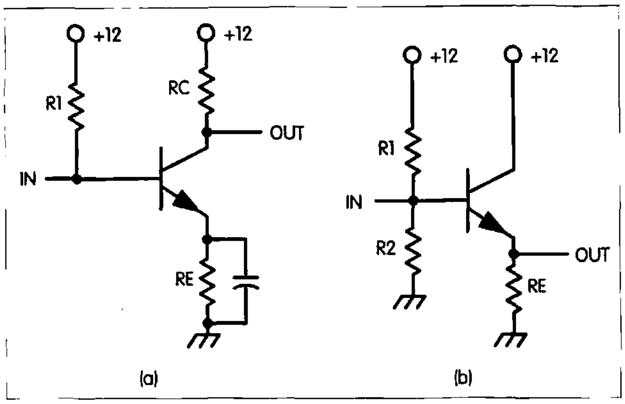

Fig. 3. (a) Self-bias can be generated in the emitter. (b) An emitter follower has self-bias.

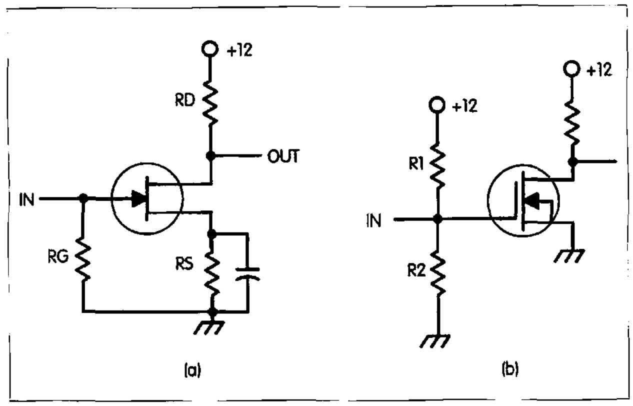

Fig. 4. (a) An FET can be source-biased. (b) A MOSFET can have fixed bias.

Transistor Bias: The Secret Story

continued from page 19

range of 1 k, so the input is essentially driving r_b.

Biasing a common base stage is shown in **Fig. 1(c)**.

The common base amplifier is suitable as an RF/IF amplifier because there is negligible positive feedback from collector to emitter. (That is not the case for a common emitter amplifier at IF.) The resistance looking into the emitter r_e is quite low, but the interstage transformer can transform the low input impedance to the desired level. The base impedance should be essentially zero. A divider of 2 k and 27 k can produce 0.6 volts and 0.1 mA to the base. The resistor values are obtained as follows: The current in R2 is 0.6 V/2 k = 0.3 mA and the current in R1 is 0.3 mA + 0.1 mA = 0.4 mA. The voltage across R1 is 12 V - 0.6 V. Therefore, R1 is 11.4/0.4 mA = 28.5 k ≈ 27 k.

Methods of generating bias in which the bias current decreases when collector current increases with higher h_{FE} are called self-bias. Self-bias tends to make the collector current independent of the variability in a particular transistor type.

Fig. 2 shows three forms of self-bias. In **Fig. 2(a)**, the bias resistor is connected to the collector. An increase in collector current decreases collector voltage, and the bias current falls, which decreases collector current. This negative feedback tends to stabilize the operating conditions of the transistor. Unfortunately, the negative feedback also applies to AC variations and reduces the gain.

The negative AC feedback can be eliminated by splitting the bias resistor R1 into two parts and bypassing their junction for the frequency of interest as shown in **Fig. 2(b)**. The reactance of the bypass capacitor should be low compared to the parallel resistance of the two resistors, $X_C < (R1a^{-1} + R1b^{-1})^{-1}$.

In **Fig. 2(c)**, when the collector load is a low DC resistance primary of a transformer, the low DC resistance doesn't offer a significant change in DC voltage with changes in collector current. Dropping the collector voltage with a bypassed resistor can produce a meaningful change in collector voltage. The DC voltage at the collector should be half the supply voltage to allow maximum output voltage swing. Since the voltage at the resistor is bypassed, the voltage doesn't change with signal and it can be fed back to the base without degeneration.

Another way of obtaining self-bias is shown in **Fig. 3(a)**. A resistor R_E in the emitter raises the emitter voltage E_E to I_C x R_E and the base voltage raises accordingly. The voltage divider in the base produces the base voltage of E_E + 0.6 V and provides the desired bias current.

For example, if the emitter current is 10 mA and R_E is 200 Ω, E_E is 2 volts and the base is 2.6 volts. When the supply is 12 volts, the bias resistor must be

(12 - 2.6)/0.1 mA = 94 k. The voltage across R_E varies with the input and causes degeneration unless R_E is bypassed.

The capacitor used to bypass R_E must have a reactance low compared to the parallel combination of R_E and the resistance seen looking into the emitter r_e. The data sheets typically do not list a value for r_e, but it is only a few ohms. Therefore, the bypass capacitance must be quite large, typically in the range of 100 µF, to bypass 300 Hz.

Biasing of an emitter-follower is similar to biasing a stage with unbypassed emitter self-bias. An emitter-follower is shown in **Fig. 3(b)**. In an emitter-follower, the output is taken from the emitter instead of the collector. The emitter follower is characterized by a high input resistance, low output resistance, 0° phase shift, near unity gain, and excellent linearity. The good linearity and stable operating point arises from the 100% negative feedback provided by the unbypassed emitter. The bias can be obtained as shown in **5(a)** or **5(b)**.

For example, if the output of an emitter follower is to be 2 volts peak-to-peak, the minimum emitter voltage must be greater than zero when the input is minimum, say, 0.5 V. The emitter voltage will then swing from 0.5 V minimum to 2.5 V maximum around a DC level of 1.5 V. The input must swing from 1.1 V to 3.1 V. When the emitter resistance is 50 Ω, the DC emitter current must swing from 10 mA to 50 mA with an average (DC) of 30 mA. Assuming h_{FE} is 100, bias must set the base at 1.5 V + 0.6 V = 2.1 V with base current of 0.3 mA.

If R2 is arbitrarily chosen as 10 k, the voltage across R2 will be 2.1 V and the current in it 0.21 mA. The current in R1 is $I_{R2} + I_B$, or 0.21 mA + 0.3 mA = 5.1 mA and the voltage across it will be 12 V - 2.1 V = 9.9 V. R1 then must be 19 k or approximately 20 k. The output impedance is r_e (a few ohms). The load seen by the input signal is $h_{FE}R_E$, 100 x 50 = 5 k, in parallel with the bias network $(10\ k^{-1} + 20\ k^{-1} + 5\ k^{-1})^{-1}$, or about 2.8 k.

Biasing FETs is even easier than biasing BJTs, because FETs are voltage-controlled. It is more like biasing a tube. (If you're familiar with tubes.) A wag once said a tube is an N-channel depletion mode JFET with a light in it to tell you when it's good. That's a fair analogy, but there is a major difference. In a depletion mode JFET, the drain and source are relative — they can be interchanged without any change in operation. You can't do that with a tube. In the JFET, the most negative terminal is the gate. The other two terminals are drain and source, but which is which doesn't make any difference. The most positive one becomes the drain and the other one becomes the source.

In a depletion mode device, the drain current is maximum when the gate-to-source voltage V_{GS} is zero. In an N-channel device, current flows into the gate when the gate is positive with respect to the source, like a grid current in a tube. A reverse-biased gate current is in the range of nanoamps, compared to microamps of contact current in tubes.

The same biasing schemes are used with JFETs that are used with tubes. Like tubes, fixed bias needs a negative supply, which may be an inconvenience, but source bias, akin to cathode bias, is most appropriate. A resistance R_S in the source, as shown in **Fig. 4(a)**, produces a voltage that raises the source potential and makes the gate effectively more negative. The drain current I_D, which is the same as the source current, produces a source voltage I_DR_S. The gate must be returned to the most negative potential.

Of course, P-channel devices use negative voltages instead of positive voltages. But otherwise they act the same.

The source voltage produces negative feedback that applies to AC as well as DC current. Bypassing the source resistor eliminates the AC variations. The bypass capacitor's reactance should be lower than the parallel combination of $1/Y_{fs}$ (equivalent to $1/g_m$) and R_S at the lowest frequency of concern. Y_{fs} is typically in the range of 2000 μmhos. When the g_m is 2000 μmhos, the resistance seen looking into the source is 500 Ω, and a 1 μF can be used to bypass 300 Hz.

The drain current vs. drain voltage curves, analogous to a tube's E_p/I_p curves, show how the current responds to V_{GS}. Drain current is essentially constant like a pentode when drain voltage is greater than pinch-off. Pinch-off is approximately V_{off}, the gate source voltage needed to reduce drain current to zero. For short channel devices, a construction characteristic not mentioned in the data sheets, pinch-off is about twice V_{off}.

It's worth noting that g_m varies with drain current and is maximum at V_{GS} = 0 V. A characteristic g_{fso}, g_{fs} with gate voltage zero, is often given in data sheets, but it is seldom realizable because the N-channel gate is usually biased negative with respect to the source and consequently I_D is less than I_{DSS}.

Enhancement mode MOSFETs are a bit different from depletion mode devices. N-channel enhancement mode devices are cut off when V_{GS} is 0 V and conduct when the gate is positive with respect to the source. The gates of these devices are insulated and do not draw current when they are positive. These devices are usually characterized for use as switches but they can be biased to operate in a linear fashion.

For example, the VN2222LL, a small N-channel enhancement mode MOSFET, is linear when the gate is about 4 V positive and the signal levels are kept small. The transistor starts to conduct with V_{GS} (gate to source voltage) of about +3 volts. The drain current is 1.5 A when V_{GS} is about +10 V. When used as a switch, V_{GS} is normally held at zero and the switching voltage raises the gate above 3 V. The drain-to-source resistance is typically

only a few ohms when the gate is 10 V or more positive. Some large die MOSFETs have R_{DS} of less than 0.02 Ω, and rival mechanical relays for low contact resistance after millions of operations.

Biasing for linear operation at 4 V only requires a voltage divider of 470 k and 1 meg from 12 V. All of the biasing schemes applicable to BJTs can be used with enhancement mode MOSFETs without concern for base current.

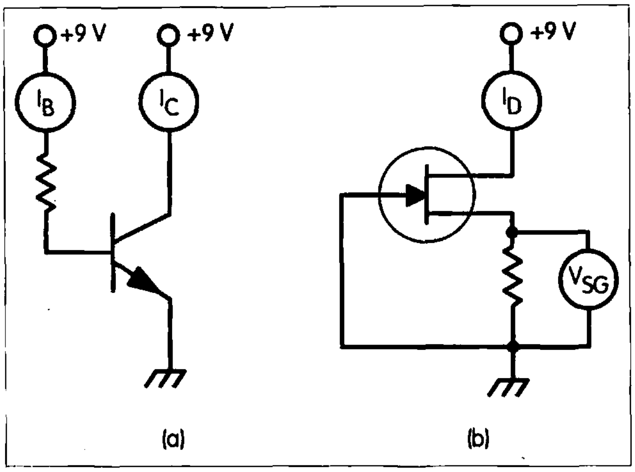

*Fig. 5. (**a**) A simple test circuit finds h_{FE} of a BJT. (**b**) A test circuit for finding V_{GS}, and I_{DSS} of a FET.*

If your requirements fall outside the box, you can bias the device to suit your particular needs. While the data sheets don't always have the data you want, some simple tests can usually generate the information you need.

Fig. 5(a) shows how to determine the h_{FE} of a BJT and **Fig. 5(b)** can answer the question of what bias voltage is needed for a FET to produce the I_D you want. A calculator is a great help in easing the calculations, but the measurements and calculations are simple.

The h_{FE} of a BJT can be found with the test circuit shown in **Fig. 5(a)**. The current in the base and the collector current are measured and h_{FE} is simply I_C/I_B. With h_{FE} known, the bias current required for any quiescent collector current can be calculated, $I_C = h_{FE}I_B$.

Finding the bias conditions for a depletion mode JFET are a bit more involved. **Fig. 5(b)** shows the test circuit for an FET. A known resistor in the range of 10 k or 20 k is in the source of a depletion mode JFET. The collector current I_{DSS} is measured with the resistor shorted and collector current I_D is measured with the resistor in place. The voltage V_{GS} across the source resistor is measured when the drain current is I_D.

The process for finding the relationship between I_D and V_{GS} is as follows: (1) Measure the drain current I_{DSS} with the source resistor shorted. (2) Remove the short. Measure the drain current I_D and the voltage V_{GS} across the source resistor. (3) With I_{DSS}, I_D, and V_{GS} determined, V_{off} can be calculated with the following equations.

$$I_D = I_{DSS}(1 - V_{GS}/V_{off})^2$$

where I_{DSS} is the drain current when V_{GS} is zero and V_{off} is the voltage needed to reduce drain current to zero. Rewriting this to solve for V_{GS} and V_{off} yields:

$$V_{GS}/V_{off} = 1 - \sqrt{(I_D/I_{DSS})}$$

$$V_{off} = V_{GS}/[1 - \sqrt{(I_D/I_{DSS})}]$$

With V_{off} and I_{DSS} known, I_D for various values of V_{GS} can be calculated with the first equation.

While you have the calculator warmed up, it is just a step away for finding the g_m and gain. Gain is g_m x R_L. R_L is the drain load and g_m is:

$$g_m = 2/(V_{GS} - V_{off}) = [2/\sqrt{(I_D I_{DDS})}]/V_{off}$$

Biasing of transistors is not difficult, even though the calculations to find the starting point may be a chore. Just keep in mind that BJTs are current-controlled. That is, the collector current is controlled by the base current. The resistance looking into the base is low. FETs are voltage-controlled. The drain current is controlled by the gate-source voltage. The resistance looking into the gate is essentially infinite.

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Kiwi TV — Pt. 1

ATV 23cm FM Receiver

New Zealand–style.

Even though this system may not be too practical for USA hams, sometimes it's interesting to follow a project along in somebody else's shoes. Here's one such case.

All I ever wanted to do in amateur television was to watch the ATV repeater, on channel 39 at 615.25 MHz. This 10 W repeater has an amateur allocation in the middle of our UHF commercial TV band.

But now I have started a TV construction project, all because of this guy Grant Taylor ZL1WTT.

He wanted to use frequency modulation for its noise immunity and its capture effect—the strongest signal always completely swamps a weaker signal. He wanted to provide stereo sound, yet the whole project needed to be assembled from affordable parts, so that the cost of any single item would not act as a deterrent. Surplus parts should be used where possible.

The drawback with this approach is that such a project cannot be engineered for mass distribution overseas. Also, many of the overseas designs use components that are too hard to get in New Zealand. We have to design with components that are locally available. Even so, some parts for the FM transmitter are disappearing.

So, I will give details of the Auckland VHF Group ATV 23cm FM receiver, as an inspiration for any project you might come up with yourself. I should also note that although we are using the European PAL system for receiving color TV, this receiver is perfectly suitable for the American NTSC system. What comes out of it as composite video is simply what goes

Photo A. Grant Taylor ZL1WTT designed and built the first FM amateur television system in New Zealand.

Photo B. Ian Pople ZL1VFO further developed the receiver.

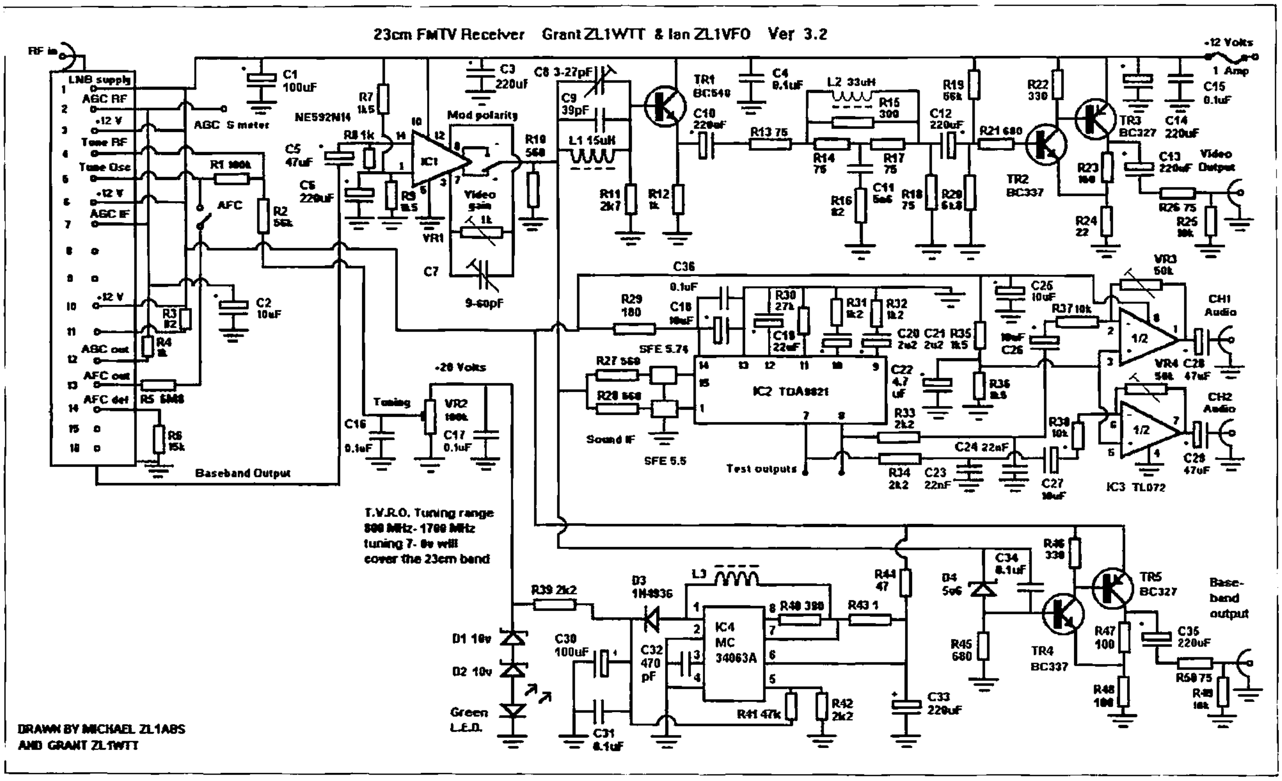

Fig. 1. Schematic for 23cm FMTV receiver.

into it as frequency-modulated ultra high frequencies at 1.28 GHz.

Grant made prototypes of the receiver and the transmitter, and did extensive tests, particularly with Wayne Griffin ZL1UKJ. Ian Pople ZL1VFO further developed the receiver, and this is the version I will describe.

The most complex part of the receiver is the analog satellite tuner, obtained surplus from Britain for less than $15 US. It has a separate RF and demodulator section. In the demodulator section, Grant increases the Phase Locked Loop time constant with an RC filter. This rolls off the high frequencies, and so reduces the bandwidth of the resulting video band, which is called the baseband from here on.

Grant demonstrated a 30 W transmission by Ralph Sanson ZL1TBG

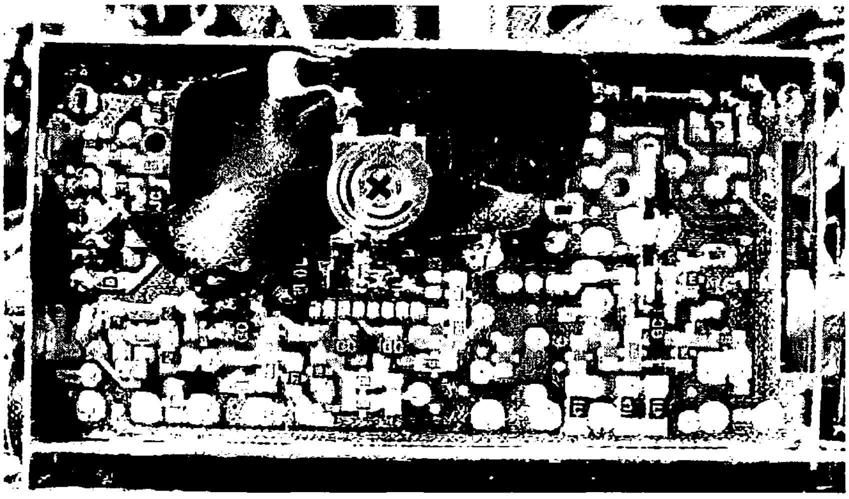

Photo C. A filter added to this analog satellite receiver IF module reduces picture noise.

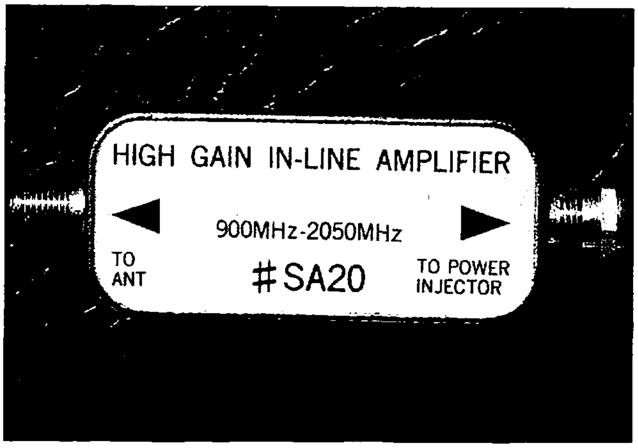

Photo D. A masthead amplifier sold for the satellite TV market is used.

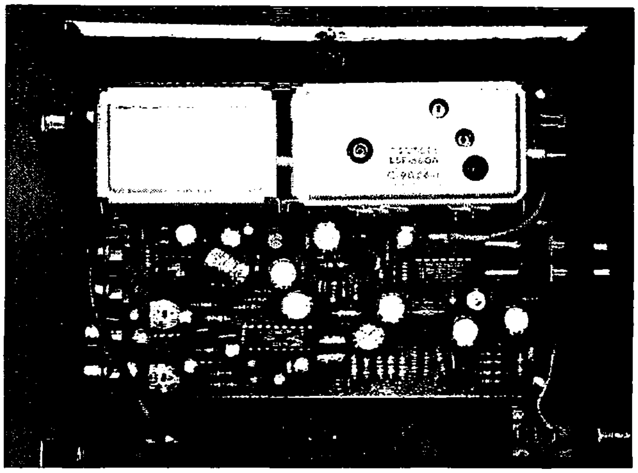

Photo E. The author's version.

from 68 km away. The modification improved the receive quality from quite noisy to nearly full quieting.

The board uses a single layer of foil, without coating. Solder bridges are possible, but the builders are generally technicians who can rectify their own mistakes.

Since the output from the satellite tuner covers a frequency range of from 50 Hz to 10 MHz, wire lead components can be used for the rest of the receiver. The tuner output is amplified in an NE592 video amplifier chip, and provision is made to change the modulation polarity externally. The signal is filtered and further amplified to produce composite video suitable for the AV input of a standard PAL television receiver.

The two sound carriers, at 5.742 and 5.5 MHz, are extracted with ceramic filters from the baseband and demodulated in a TDA9821 chip. This is a German A2 sound demodulator. Since the sound is transmitted in two separate subcarriers, no stereo decoding is necessary. A dual op amp (TLO72) provides line-out volume for the two sound channels.

There is a separate unfiltered baseband output provided, allowing for retransmission of the received signal complete with sound.

The whole receiver needs a regulated supply of 13.8 volts at 1 amp. The satellite tuner is very susceptible to induced hum. I use a locally made switch-mode power supply, rated at 3 amps continuous, which gives me no interference pattern on the TV.

Tuning this receiver, however, calls for 20 volts. It is provided by another switch-mode power supply on the receiver board. It employs an MC34063 chip, a 1N4936 diode, and a custom-made coil. These three components came from wrecked cell phones. A multi-gang potentiometer allows uncritical manual tuning.

This receiver does need a masthead amplifier. Shown here is a # SA20 high-gain in-line amplifier covering 900 to 2050 MHz. Grant says, "This can be obtained from your local satellite supplier. It also helps to use a GaAsfet preamp on the front of the line amp."

Michael Sheffield ZL1ABS can supply photos and drawings of the whole project on e-mail, via [zl1abs@xtra.co.nz].

He also says that loop yagi kit sets for the 23cm band can be obtained from Directive Systems, RR #1, Box 282, Dixon Road, Lebanon ME 04027 USA; tel. (207) 658-7758; fax (207) 658-4337; e-mail: [sales@directive-systems.com]. Their Web page is at: [http://www.directivesystems.com/antenna.html].

My receiver will be my first test instrument for the transmitter yet to be started. Grant tuned it up for me. "You can congratulate yourself," he said. "This is the first built-up kit that worked first time I switched it on."

Thanks very much to Grant Taylor ZL1WTT for his assistance with this article.

Henry Falkner ZL1AAN
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Auckland 1309, New Zealand

Kiwi TV — Pt. 2

ATV Exciter

Latest addition to the Kiwi 23cm project.

The successfully completed 23cm receiver became a test instrument for a 23cm transmitter. Several transmitter PC boards are distributed by Wayne Griffin ZL1UJK, P.O. Box 28-300, Remuera, Auckland 1136, New Zealand. The essential one is the exciter board.

Grant Taylor ZL1WTT (Photo A, Pt. 1) had started with a free-running oscillator design from the British Amateur Television Club. He added a modulator, dual varicap tuning, and a prescaler for phase-locked-loop control. Wayne Griffin ZL1UJK did much of the circuit board layout.

The exciter, shown on the right half of the circuit diagram, is capable of producing a microwave signal typically between 1200 and 1300 MHz video directly from a camera, and two sound carriers for stereo transmission, derived from the German stereo broadcast concept.

Photo A. Wayne Griffin ZL1UJK.

The modulator

A video camera can be directly connected to the filtered input of the NE592N-14 modulator chip by Philips. The filter shown provides PAL pre-emphasis. Sound has to be modulated first. For stereo, we use 5.5 MHz and 5.74 MHz subcarriers in New Zealand. The two preset potentiometers connected to pins 3-4 and 11-12 of the NE592N-14 chip provide video gain, and high frequency boost if needed. The preset on pin 7 or 8 controls modulation linearity. This part of the circuit handles frequencies below 10 MHz.

The exciter

Surface mount devices are used when available. The 23cm oscillator uses a bipolar BFR91 transistor in common base configuration, two coils, three biasing resistors, and a microstrip.

Varicap diode VC2 tunes the oscillator via the microstrip, manually by means of the preset VR4, or with an external phase-locked-loop board (PLL). The oscillator supply voltage is one of the parameters controlling the tuning range. The 78L08 regulator with the yellow LED provides 9.6 volts. Coil L3 is a choke, stopping microwave frequencies at that point.

Diode VC1 varies the tuned frequency within a range less than 10 MHz, which is the frequency modulation we require. Again, choke L2 stops microwaves from appearing at the modulator chip.

The two varicap diodes, DC-isolated by a 4.7 pF capacitor, keep the deviation reasonably constant over the tuning range of the microwave oscillator. The deviation is the amount by which the modulating frequency varies.

A second microstrip is loosely coupled to a buffer transistor, which is another BFR91, but this time in common-emitter configuration. It feeds a predriver stage. In the diagram, the predriver is an ERA5 IC.

Manual tuning is provided. But phase-locked-loop tuning is desirable for precision. It also permits transmitter switching, and adding a numerical frequency display. Both the PLL board and the frequency display are on separate boards. In fact, I have yet to construct them.

Grant Taylor ZL1WTT has included a divide-by-256 prescaler on the exciter board. The SAB6456 chip, from Philips, is being discontinued. RADIO SPARES lists, in Britain and here, an alternative prescaler suitable for microwave frequencies.

The prescaler output is buffered by a BC549, which has high gain. At the transistor collector, tracking of the tuning can be observed on a frequency meter and an oscilloscope, within a range that these instruments can handle. The prescaler output frequency varies typically between 4.5 to 5.3 MHz, which is easy to shunt to an external PLL board. For microwaves, any length of coaxial cable is more of an attenuator than a conductor.

Continued on page 28

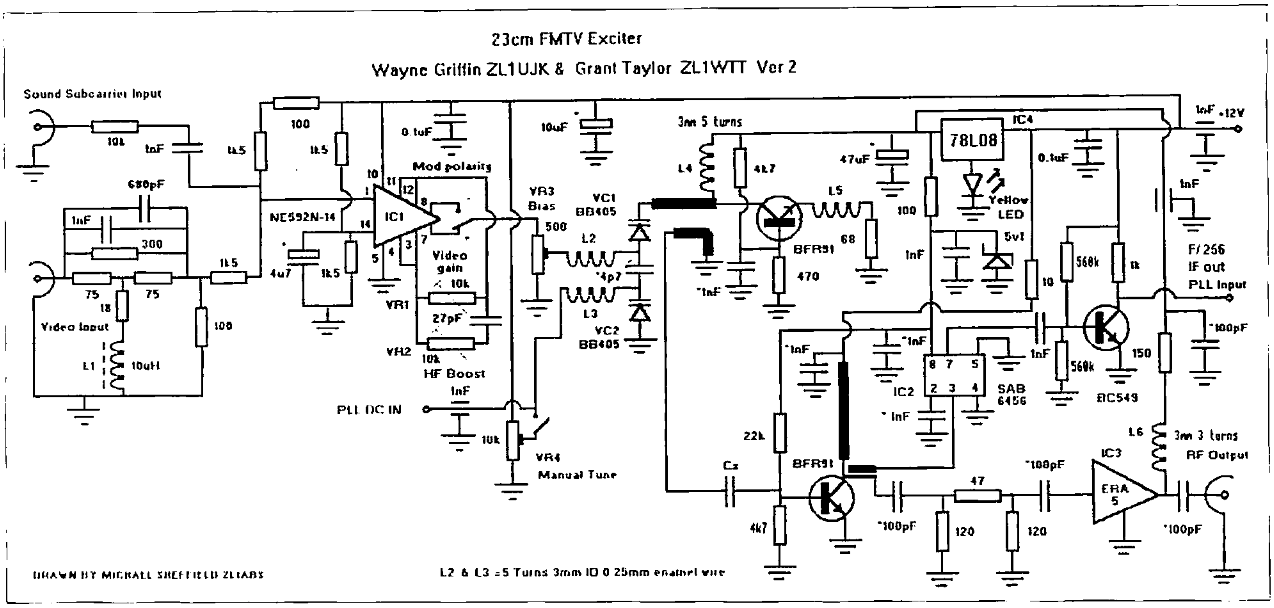

Fig. 1. Exciter board with video and sound modulator, a buffered 23cm oscillator, and x256 prescaler.

ATV Exciter

continued from page 27

Construction

Again, Grant Taylor ZL1WTT, tells me, I am the first one to get the exciter board going without him having to troubleshoot it. He says that the problems he sees are mistakes in the choice and placements of components, and construction technique.

Faults I had to rectify during testing were the wrong polarity of the electrolytic capacitor at pin 14, and not linking pins 3-4 and 11-12, at the NE592 chip.

The 75 and 300 ohm resistors in the PAL pre-emphasis (to the left), I could only obtain at a surplus store.

I used a 78L06 regulator, a blue LED, and a 100 ohm resistor to get a 9.6 volt supply for the oscillator. I used a BB833 varicap tuning diode for VC2.

This gives a tuning range of 1180 to 1360 MHz, with constant deviation and good linearity. Position of varicap diode VC1, a BB405 as specified, shifts the tuning range up or down (center of schematic).

The coils are not critical. Oscillator coil L5 is 1.5 turns of the tail of the 68 ohm emitter resistor, 3mm (1/8 inch) in diameter. The board layout requires that one of the biasing resistors has leads. Short tails are essential to minimize unwanted stray capacitance and instability.

The SAB6456 prescaler chip is designed for up to 1000 MHz (1 GHz). It is persuaded to work beyond 1.3 GHz by trimming its pins and mounting it prone on the board. I also put in pins to link the topside groundtrack and the bottom, plain side of the double-sided board.

Continued on page 57

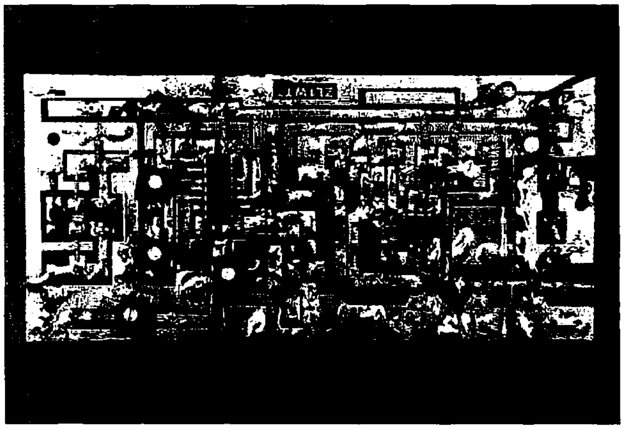

***Photo B.** This photo shows two metal screens between modulator, oscillator/buffer, and predriver. I made them 1 inch (2.5cm) high. The presets are sealed types. Open types will work, but they may become intermittent.*

***Photo C.** Trombone player Jane Hart from the folk band "Bantam at the Opera," at the Auckland Folk Festival.*

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Jamaica NY 11432

Vaya Con (Ra)Dios

The radio amateurs of Spain — part 3: Madrid and Valencia

When I prepared my Spanish trip, besides my extended correspondence with Xavier EA3ALV, the editor of the Spanish CQ magazine, I also wrote to U.R.E., the Radio Amateur Association of Spain, asking their cooperation in finding amateurs I could visit. In the beginning our collaboration was slow, but still I decided to go to Madrid to see them and some local hams.

I also wrote to His Majesty Juan Carlos, the king of Spain, known to us as EAØJC, asking for a chance to visit and photograph him in his radio shack. I received an answer from one of his aides saying that an interview could not be arranged due to the busy agenda of His Majesty. I wrote again asking, as a second choice, for a photograph and some facts about HM's radio amateur activity. I received a second answer saying, "Be sure, I will do my best to find a gap in the schedule of HM the King"; however, the letter arrived after I left already for Spain. I believe that if I had signed my letter as "George Pataki, Count of Transylvania" or given as an alternative residence the New York Governor's office in Albany, I would have had a better chance.

Nevertheless, I have obtained from other sources a photograph of EAØJC at his radio station and his QSL card (**Photo A**). Many amateurs have worked EAØJC, but the vast majority have contacted the second operator, José, and, after his retirement, Isaias. I also found out that Margarita de Borbon y Borbon de Zurita, the sister of HM the King, is EA4AOR, and I even saw one of her QSL cards.

I also exchanged some E-mails with Isi EA4DO (**Photo B**) whom I met in 1970 during my first visit to Madrid. At that time a very young boy, Isi was the second operator at his father's station, also EA4DO.

From Barcelona, I took an early morning train to Madrid. Not knowing that on the same route are different types of trains, with different prices, it happened that I took the most expensive one, and for a first class ticket I paid 8,300 pesetas, about $56. With another train, on 2nd class, I would have paid only 4,900 pesetas, about $33. I could not notice much difference between the trains except that the faster they go, making fewer stops, the more expensive they are.

At every major railway station, at the information office, you can get a computer printout with all the trains going to your destination, with times of departure and arrival, type of train (which determines the cost of the ticket), etc. Also, in every major city there are one or more tourist information offices. One is usually at the railway station, where maps and various useful facts can be obtained, like a list of reasonably priced hotels and hostels, points of interest etc.

In Madrid, Juan, U.R.E.'s administrative secretary, was waiting for me. He took me to their headquarters, in a spacious four-story building. I was surprised to find out that U.R.E. has only 12 paid employees and only one of them, a Novice, has a radio amateur license. Four of these people work in the QSL bureau, sorting cards, and one is handling the packing and mailing;

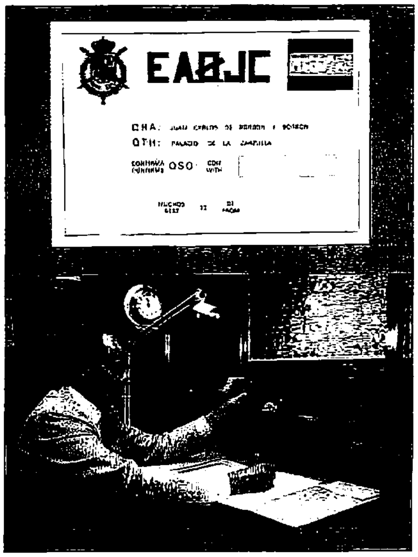

***Photo A.** QSL card of His Majesty Juan Carlos EAØJC.*

Photo B. The author first met Isi EA4DO in 1970.

Photo C. Leopoldo EA4GT is a retired electronics specialist.

thus only seven are doing administrative and organizational work. However, it seems that they are doing a good job.

U.R.E.'s general secretary is Angel EA1QF. He lives about 200 miles from Madrid and he comes there only when necessary. Angel was licensed in 1976, and is a computer and communications specialist. He is a DXer and is on Honor Roll #1, missing only Scarborough and North Korea.

He is an award hunter and was active from several Spanish islands. In October 1998 Angel participated in the TJ2RSF expedition. He collects radio amateur pins, so if you go to U.R.E., take some pins with you.

U.R.E.'s president for the past 12 years has been Gonzalo EA1RF, who lives in Orense, Galicia, quite far from Madrid. He is a great talker. I saw him talking on the telephone nonstop for about 10 minutes, without giving the guy on the other end a chance to say a single word.

U.R.E. has 16,500 members out of a total of 60,000 licensed amateurs; however, there are 271,000 CBers in the country. It is interesting that the province of Madrid, which includes the capital city (the largest city in the country), has 1,921 class A amateurs, while in Barcelona province there are 2,700 class A hams.

The maximum allowable power for class A is 800 W, but I saw many amplifiers capable of delivering 2–3 kW PEP.

At the U.R.E. headquarters, there are four operating positions for EA4URE: HF, VHF-UHF, satellites, etc. On the roof, at 48 feet from street level, they have three towers. The tallest one, a 32-footer, has a 7-element yagi for 10-15-20-40 meters, a vertical for 2 meters and 70cm, and a 9-element vertically polarized yagi for 70cm. On a 19-footer, there are two yagis with crossed elements for 2 meters and 70cm, used for satellite communications, and a wideband discone. On a third tower, also a 19-footer, there is a log periodic for 2 meters, a 13-element yagi for 2 meters, a 21-element yagi for 70cm, and a couple more experimental antennas.

The QSL service, both incoming and outgoing, is free for members.

U.R.E. publishes *Radioaficionados:* a monthly magazine resembling *CQ* published in the US, with more color photos but fewer pages. The coordinator, which is like a managing editor, is Juan, the administrative secretary.

U.R.E. organizes national contests and is sponsoring several awards like EADX100, TPEA, ESPANA, 100EACW, CIA, TTLOC, and Locator EA. U.R.E.'s Web page is at [http://www.ure.es] and their E-mail is [ure@ure.es].

Years ago when I visited Spain, they had a socialist government. Coming from "socialist" Romania, I was very curious how this system worked in Western Europe. In Eastern Europe socialism was an economic disaster; nothing worked properly, people were

Photo D. Jose EA4BPJ was first licensed in 1981.

Photo E. DXCC Honor Roller Xavier EA4AV is an avid DXer and sometime contester.

unhappy, but could not do or say anything. In Spain, however, going from city to city I saw prosperity, stores full of merchandise, freedom of expression, to travel, to do business, etc. Houses, banks, farms, factories, etc., were in private hands, and people were working for themselves and were satisfied. It was very confusing to me. Finally, one day, during sightseeing, I entered into a dingy little eatery looking for the men's room. I found it, but it was filthy and stinky; it was just like the public toilets in Eastern Europe. Eureka, I said, I found socialism, the kind I knew from home.

Later, I found a cheap hostel close to Gran Via for 3,200 a night, with the bathroom and shower at the end of the hall, but the location was convenient. I stayed there two nights.

In a restaurant a patron is complaining that the meat is very small. The waiter tells him:

"You will be surprised to see how long it takes to chew it!"

Once, I asked a man wearing dark glasses and carrying a white stick, who was selling lottery tickets, a job usually performed by people with handicaps, in which direction lay Puerta del Sol. The man not only indicated the direction, but gave me very detailed instructions on how to get there. I wonder if he really was sightless ...

Juan from U.R.E. arranged a meeting with Isi EA4DO, whom I had not seen for 29 years, and with Alan GW3INW, who was doing research on the communications equipment used in Spain during the Civil War. I had already seen some of his article on this subject in the *Spanish CQ* magazine.

We went to Majadahonda, about 10 miles from Madrid, to see Isi's station, EA4DO. Licensed in 1964, Isi is a pharmacist testing additives for the food industry. Both his parents were radio amateurs; his father Isidoro EA4DO was president of U.R.E. from 1960 to 1965.

Isi's tower is a 70-footer; it carries a 7-element yagi for 10-15-20 meters, and a 3-element yagi for 40 meters, both from KLM. He works the WARC band with the antenna tuner. Isi also has two inverted V antennas, one for 40, the other for 80 meters. He is on Honor Roll #1, and has the 7BDXCC, 5BWAS, 5BWAZ, 5BEUROPA, 5BASIA, etc.

His most important activity started in 1991 — doing research on the history of amateur radio in Spain. He even works on his doctoral dissertation on this very same subject. He has published several articles in the *Spanish CQ;* U.R.E.'s *Radioaficionados,* and the *R.C.A. of Argentina.* Isi has compiled a rich archive with data on the pioneer Spanish hams: photographs, QSL cards, magazines, diplomas, awards, various documents. He has created a display of these items and old communications equipment, tubes, parts, test instruments, all related to early amateur radio activity in Spain. Seeing his display, which occupies a large room in his house, was quite interesting and educational; meeting Isi EA4DO again after 29 years was a pleasure. I believe we should not wait another 29 years till the next meeting, so I have penciled him into my calendar for the year 2025.

Madrid, the capital city, is full of bureaucrats employed in various offices.

A foreigner found a government building closed in the afternoon and asked the watchman: "Here, the employees don't work in the afternoon?"

"They don't work too much in the

Photo F. Julio EA4BM is a retired military translator, first licensed in 1935.

Photo G. Jose EA4JL is a vintage equipment aficionado.

morning either, but in the afternoon they just don't come in!"

The national pastime in Spain is soccer, called football. Devoted fans will do anything to attend the games.

In some government offices notes are posted: "Employees planning to attend funerals of their closest and most beloved family members are required to inform their superiors at least one day before any championship game. Thank you."

I met Leopoldo EA4GT (**Photo C**), a retired electronics specialist, in front of my hostel; I was wearing my cap with name and callsign. He took me to his house in Pozuelo de Alarcon, six miles from Madrid. He has a 33-foot tower with a 3-element TH3-MK3 yagi for 10-15-20 meters, a trapped inverted V for 40 and 80 meters, and a double dipole for 12 and 17 meters. For rigs, Leopoldo is using a TS-870 and a TS-930S with a 1 kW homemade amplifier and a homemade transmatch, both with vacuum variable condensers. For 2 meters, he has a TM-221A. Leo is a builder; his shack is full of his projects. He has many awards like the 7BDXCC, 5BWAS, 5BWAZ, etc., and is on Honor Roll #1. His photo was featured on the cover of the *Spanish CQ* magazine. He is a hunter, and his house is full of trophies. Leo is doing computer logging as well as the paper logging required by regulations. He has a nice QSL card.

Leopoldo drove me to U.R.E., where I met Angel EA1QF, the general secretary, and Gonzalo EA1RF, U.R.E.'s president. Both serve as volunteers, and several amateurs operate the headquarters' station EA4URE.

One of the hams I met there, Delfino EA4BOD, has had an interesting life. In 1937, he was taken from an orphanage to the Soviet Union where he went to school, grew up, got married, had children, and stayed till 1975, when he returned to Spain. He operated from Antarctica as EDØBOD when he worked there with a scientific research team.

At the radio station I also met Jose EA4BPJ (**Photo D**), a computer specialist licensed in 1981. Jose is a DXer, with about 300 entities worked for his DXCC; he is the chief operator at EA4URE and president of the radio club at U.R.E.'s Madrid branch. His wife Susana is EB4FSE, and his brother Sergio is EB4FRS.

I saw Felipe EA4UR at one of the four operating positions of the station. He was working them like in a contest — fast and many.

Photo H. Placido EA4KU and Pablo EA4JW showed off the EA4RCU club station in Madrid.

Photo I. Jorge EA4EO's impressive station is completely self-designed and -built.

I also operated the station on 20 meter SSB using the special call EG50URE, commemorating the 50th anniversary of U.R.E. In 1949, after World War II, amateur radio in Spain was again authorized. Even with unusually bad propagation, I worked about two dozen stations. The highlight was working my friend Leo YO2BM from my hometown of Timisoara, with Shalom 4Z4BS and Ludwig DL5MHQ, both originally from Romania. So there were four stations in four countries, on two continents, all talking Romanian.

At U.R.E. I met Francisco EA4AHK, president of Radio Amateurs Without Frontiers, a nongovernmental organization founded in Madrid in 1995. The organization is running 40 telecommunications projects with teams of doctors and missionaries in Chad, Western Sahara, Cameroon, Tanzania, Congo, Congo Brazzaville, Rwanda, Togo, Mali, Honduras, Nicaragua, Albania, etc., with calls SØ1RSF, TJ2RSF, EA4RSF, TT8FC, 5H3FH, TZ6ASN, etc. For emergencies, they used the 14.128 MHz frequency, at 15.00 UTC.

I heard about José, the brave DXpeditioner, who went on a safari in an African country with a local hunter.

"These are marks made by a big lion; I will follow them to see where he went," said the hunter.

"I will go in the opposite direction," said José, the brave DXpeditioner, "to see where he came from!"

Another time, this happened:

A traveling salesman is offering a very poor man some luggage.

"What should I do with them?"

"Well, you should pack your clothes when you travel."

"And I should sit naked on the train?" asks the very poor man.

I visited Luis EA4OX, a retired airline pilot for Iberian Airlines, and his wife Ana EA4RO, a former stewardess, both licensed in 1974. They have a Cushcraft R5 vertical antenna and a TS-440S. In their second home in El Escorial, about 30 miles from Madrid, for low frequencies they use a Cushcraft R7 with a Heathkit HW-101, and for 2 meters and 70cm they have a vertical Ringo and a TM-231A. Both have nice QSL cards and work only on SSB, mostly with Spanish stations. They have a family of hams: Son Luis Jr. is EA4AID, and daughter Carmen EA4YV.

I went to see Xavier EA4AV (**Photo E**), a computer engineer licensed in 1980. On his 48-foot tower, installed on the roof at 64 feet from the ground, Xavier has a Hy-Gain Explorer 14–type of 3-element yagi for 10-15-20 meters, a trapped inverted V for 40 and 80 meters, another dipole for 80 and 160 meters, and a vertical for 2 meters. Xavier has two identical TS-930S transceivers and an Ameritron AL-80B amplifier. On 2 meters, he is using an IC-251. Xavier EA4AV is a DXer and sometime contester. He is DXCC Honor Roll, and has 7BDXCC, 5BWAS, 5BWAZ, 5BEADX100, and many more prestigious awards. He has QSL cards and has worked EAØJC with the first operator, HM Juan Carlos, the king.

I visited Julio EA4BM (**Photo F**), a retired translator for the military, licensed in 1935. He is using a W3DZZ antenna for 10 to 80 meters, an FT-767GX, and an IC-751. He is a DXer, worked over 200 entities on CW and SSB. Julio used to build his equipment, but now he prefers factory-made gear. He has QSL cards, just the kind I like, with big, wide letters for the callsign. He had a QSO with EAØJC — the second operator, not the King.

I went to see José EA4JL (**Photo G**), a mechanical engineer licensed in 1966. José likes vintage equipment and has quite a little collection. He uses Collins, with an Alpha 374 amplifier. His antenna farm has a 3-element yagi for 10-15-20 meters, from Hy-Gain; a vertical for 10-15-20-40-80 meters; an inverted V for 40 and 80 meters; and a wire dipole for 12 and 17 meters. Like every respectable well-to-do Spaniard, José has a second house in Navacerrada, 25 miles from Madrid. There he has another station with a Signal One, and, having more room, he has installed a homemade 4-element quad for 10-15-20 meters; a 4-element monobander yagi for 20 meters from Wilson; a 5-element tribander yagi for 10-15-20 meters from Hy-Gain; inverted Vs for 40, 80, and 160 meters; and 3 beverages, each

Photo J. Eusebio EA5CA fired up the EA5UPV club station in Valencia.

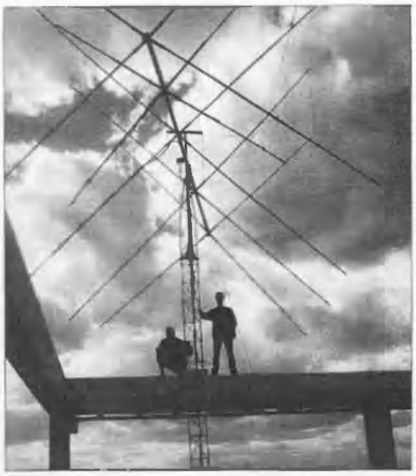

Photo K. Javier EA5AUB and Henrique EA5FIB are not just ops at the Polytechnic University of Valencia's EA5UPV — they also take care of the antennas.

640 feet long, and in different directions. Jose EA4JL is on Honor Roll #1, has the 5BDXCC, WAZ and many other awards. His son Jorge EA4LH, a mechanical engineer, made DXCC on satellites.

Next I visited the radio club of U.R.E.'s Madrid section, where the president is Jose EA4BPJ. They have a small station, EA4RCU, but with an enthusiastic group of amateurs. They usually come there in the evening to leave and pick up their QSLs and talk about what they worked and what they missed. I met there Javier EA4TK, an electrician who has over 300 entities for his DXCC, working only SSB: Jose EC4WZ, a security guard, who works some contests and has over 100 entities; Carlos EA4BDO, a DXer and award chaser with over 250 entities, who works SSB and SSTV; Jose EA4ECF, a building administrator, who operates SSB and CW; Placido EA4KU, a retired building constructor with 225 DX entities worked mainly on CW; and Pablo EA4JW, a product manager in a clothing factory, who worked over 200 entities for his DXCC, mainly on SSB (**Photo H**).

The last one visited in Madrid was Jorge EA4EO (**Photo I**), a very unusual amateur. Licensed in 1953, he is retired from NASA's Madrid Deep Space Tracking Station, where he was a supervisor in the test equipment laboratory. Everything he has and uses, and I counted 20 pieces of equipment, with more on the workbench, was designed and built by him. He has published several technical articles in ham magazines, and one of the pieces of gear he built was featured on the cover of the *Spanish CQ* magazine. His antenna is an original variation of the Comudipole antenna, which is a coaxial, multiband dipole working on the 10-12-15-17-20-40 meter bands. Jorge has a nice QSL card. His uncle Enrique is EA4EP, one cousin is Carlos EA4KC, another cousin is Kike EA4ASA.

Not having too much to do in Madrid, I decided to go to Valencia,

Photo L. Jose EA5GKT has what sounds like a challenging job: mechanic in a car wash.

Photo M. Enrique EA5AOR went on an Isla de Buda DXpedition ...

which was highly recommended by Eddie EA3NY. I had learned my lesson: I bought a second-class ticket on the cheapest train I found leaving early morning. It stopped in many places, but I got to Valencia in the same time the first class passengers did.

The radio amateurs of Valencia

The last big city on my tour of Spain was Valencia. It was recommended by Eduard EA3NY and it followed Madrid. Eduard called up Pepe EA5KB, told him about my project, and asked him to arrange some visits.

At the Valencia railway station, Eusebio EA5CA (**Photo J**) was waiting for me. Pepe EA5KB, who was busy preparing an IOTA convention in Alicante and hosting Yuki JI6KVR who came for the convention, sent him.

First I had to find a place to sleep. Right in front of the railway station was a rundown hotel, but it was high-priced.

"Why is this so expensive?"

"Because it offers free entertainment all day long."

"What kind of entertainment?"

"You can watch right from your window all the people who missed their train!"

Eusebio EA5CA, licensed in 1979, runs his computer-aided design company and creates very sophisticated programs. He has a 38-foot tower on the roof, 80 feet from ground. For antennas, he is using a C4XL type of 9-element yagi for 10-12-15-17-20-40 meters from Force 12, a rotatable rigid dipole for 80 meters, a delta loop for 80 and another one for 160 meters, and a Diamond vertical for 2 meters and 70 cm. Eusebio has plenty of rigs: an FT-1000D, an FT-1000MP, an IC-970H, an IC-756, a 2.5 kW Ameritron AL-1500 amplifier. For 2 meters, a 1 kW Henry 2002A amplifier. Eusebio's English is excellent. He works SSB and SSTV, is a contester and occasional builder, but most of all he is a DXer with over 310 DX entities. He has worked EAØJC and has nice QSL cards in various color combinations.

I got used to hearing about the second house many Spanish amateurs have, with second stations, big antennas, and amplifiers. Eusebio also has a second house in Naquera, and a third one in Denia with a complete station for DXing and contesting.

Eusebio took me to the radio club of the Polytechnic University of Valencia, which has several rooms and big antennas, and is where the EA5UPV station is located. On a large and very high roof, I saw a quad, a log periodic, and several yagi antennas. The station has several rigs; in one room is an IC-756 with an Ulvin Tremendus III amplifier capable of delivering 5 kW, and for 2 meters and 70cm, an IC-821. In a second room, I saw a TS-870, an IC-821, and a second Ulvin amplifier, identical with the first one. The third room has an FT-920 and an IC-756. The director of the radio club is Fausto EA5AFC, a professor of electronics. Javier EA5AUB and Henrique EA5FIB (**Photo K**), are operators, and they take care of the antennas as well. Besides the regular modes of operation, in this club experiments on color ATV on the 1.2 GHz band also are conducted. I did not see any QSL cards.

Eusebio also took me to Jesus EA5DOQ, a psychologist licensed in 1979. Jesus has a 45-foot tower on a 128-foot-high roof with an X-9–type Cushcraft, which is a 10-element (ten, yes ten, it is not a misprint) yagi for 10-15-20-40 meters, an inverted V for 80 meters, and a vertical for 2 meters. He has a couple of rigs, among them an IC-756 and an Ameritron 1 kW AL-80B amplifier. Jesus has a nice QSL card. He operates SSB, CW, RTTY, SSTV, packet, DX cluster, and contests, and is a DXer with 315 entities. With his antenna and equipment, it would be a shame to have anything less than that.

Finally, we met Pepe EA5KB, who came with Yuki JI6KVR. We had lunch together, and then we went to Pepe's house. An industrial engineer licensed in 1984, Pepe is married to Ana EA5CY, licensed in 1987, a post office employee. Both are contesters and DXers, and members in EA DX Club, Pepe with 333 entities and Ana with 205. They have a 4-element yagi for 10-15-20 meters, a TS-440S, and a TL-922 2 kW amplifier. They do computer logging, have DX cluster,

Photo N. ... As did Bernardo EA5AOP.

Photo O. Enrique EA5CMC has worked EAØJC twice.

work on SSB and RTTY. Pepe is an award and island chaser with 729 IOTA islands worked; he has operated from 12 islands. He worked EAØJC's second operator, Jose. Both have QSL cards. Pepe's E-mail is: [ea5kb@ctv.es].

Next I saw Paco EA5BHK, an electronics technician licensed in 1979. His wife Paquita EB5EGV was licensed in 1984 and is working in commerce. The antennas are: a 4-element yagi for 10-15-20 meters, a 2-element yagi for 40 meters, both from KLM, and a dipole for 40 and 80 meters. They have an FT-1000 with an FL-2100Z, and an Ulvin Tremendus III amplifier. Paco is a member of Lynx DX Group and the EA DX Club. He is a DXer with 316 entities, and has lots of awards like the 5BDXCC, 5BTPEA for working all Spanish provinces on 5 bands, WAS, WAZ, WAE, DIE (the Spanish Islands award; he has worked over 600 Spanish islands), and others. Paco is not only an island chaser but he also has operated from 12 Spanish islands. Both have nice QSL cards. Paco EA5BHK has worked EAØJC, second operator Jose.

Fernando EA5AT, licensed in 1983, is selling wood products for building construction. He has a 38-foot tower on the roof 90 feet from the ground. His antennas are a 3-element yagi for 10-15-20 meters with an extra element for 40 meters, dipoles for 80 and 160 meters, and a vertical for 2 meters and 70cm. He uses a TS-940S with a 500 W FL-2100B amplifier, and an IC-251A. Fernando is a DXer, having worked every existing entity except for Bhutan and North Korea. He is also a member of the prestigious Lynx DX Group, having over 1800 points for the Lynx award. He is on the DXCC Honor Roll, WPX Honor Roll, IOTA Honor Roll with 825 islands, has 7BDXCC, WAZ (ITU) Supreme Award #1 plaque, WABA plaque (Antarctic Bases), 5BWAS, etc. Needless to say, he is an award chaser and he does QSL.

Jean-Marie EA5HE, a bus driver licensed in 1983, was the next for us to see. On his 22-foot tower installed on the roof, 93 feet from ground, he has a TX6DXX-type 6-element yagi for 10-15-20 meters, a wire dipole for 40 and 80 meters, and a vertical for 2 meters. He is using a TS-440S. He is an occasional contester, and a DXer, having worked every entity except North Korea — not bad for using only 100 W. Jean-Marie has QSL cards.

Fernando EA5AT and Jean-Marie EA5HE took me to the radio club of U.R.E.'s local branch, where the radio station EA5URV is located. The club claims 440 members and has several rooms: a very large one for meetings and classes, one for the station, and another one for the Internet. In the big room, you can buy food and soft drinks. The members come on Thursdays from 6 p.m. to about midnight. The antenna is a Hy-Gain 3-element yagi for 10-15-20 meters, a dipole for 40 and 80 meters, and a vertical for 2 meters and 70cm. The rig is a TS-930S. They operate SSB and CW, have packet, DX cluster, and a nice color photo QSL card. I met the club secretary, Manuel EA5ELF, an auto mechanic, and the president, Manolo EA5FSK, a retired Guardia Civil sergeant.

About 22 miles from Valencia is the city of Carlet. There I met Paco EA5ADT, who was licensed in 1989 and works in the Ford automobile factory. He has a rotatable rigid dipole for 10-15-20-40 meters, and another rotatable rigid dipole for 12 and 17 meters, an inverted V for 40 and 80 meters, and a vertical for 2 meters. His rigs are a TS-120S, a TS-140S, and for 2 meters he is using a TS-255E. Paco works SSB, SSTV, sometimes on satellites, has 290 DX entities, and uses a nice QSL card. He has also worked EAØJC, second operator Jose.

Also in Carlet I visited Jose EA5GKT (**Photo L**), a mechanic in a car wash, licensed in 1989. His 29-foot tower stands on the roof 96 feet from the ground and supports a 3-element yagi for 10-15-20 meters, an inverted V for 40 and 80 meters, and a vertical for 2 meters. It seems that many Spanish amateurs prefer this kind of antenna setup. Jose has a TS-440S, has 120 entities for his DXCC, works on SSB, CW, SSTV, and 2 meter packet. Jose also has a nice QSL card.

In Carlet, there is an active radio club that organizes island DXpeditions like the one to Isla de Buda with operators Manuel EA5GLT, Enrique EA5AOR (**Photo M**), Bernardo EA5AOP (**Photo N**), and Ricardo EC5AHM.

Two members of a radio club were not getting along, and the others tried to pacify them. One of them stretches out his hand, saying: "Let's be friends again, and I wish you all the things you wish for me!"

Photo P. Augusto EA5CTU has a 45-foot tower on top of a 96-foot-high roof.

Photo Q. Jose EA5EE has three HF transceivers, three HTs, and four computers.

The other gets angry and yells: "See, he's starting again!"

Another time, a ham buys some coax cable and says to the salesman:

"It seems that the yardstick you are using is shorter than the other one."

"That is true, but is also much thicker!"

In Alcudia, right near Carlet, I saw the station of Enrique EA5AOR, a plumber licensed in 1993, who, working mostly SSB, already has accumulated 290 DX entities. Enrique has a Cushcraft A-3S 3-element yagi for 10-15-20 meters, and a vertical Diamond X-200 for 2 meters and 70cm. He is a member of the EA DX Club and has two kinds of nice QSL cards: On one he is pictured in his bicycle-racing outfit with his racing machine. He does computer logging with the KINGWIN program made by EA7ABW. He is an award hunter and an island chaser; he operated from several Spanish islands for the IOTA program. From his station, I had a QSO with my friend Bandi HA5CQ, a DXer and active net controller. I had met Bandi personally in Budapest and I was pleased to hear a familiar voice. Enrique was driving me around from city to city, from one ham to another.

Enrique took me to Alginet to see Bernardo EA5AOP, a housepainter licensed in 1995. Bernardo has a multiband wire dipole for 15-20-40-80 meters, and a vertical for 2 meters. For the low bands, he is using a TS-140S, and for 2 meters he has a FT-212RH. He works SSB, some SSTV, is an island chaser and has 120 DX entities. His QSL card has a nice color photograph.

In Algemesi, Enrique EA5AOR took me to another Enrique, this one is EA5CMC (**Photo O**), a machine operator in an orange-packing factory, licensed in 1977. His 48-foot tower sits on the roof 64 feet from ground and supports a Cushcraft 3-element yagi for 10-15-20 meters with a driven element having also 40 meters, as well as some VHF and UHF yagis. Enrique has a TS-850S and an FT-2400 for 2 meters. He operates on SSB and SSTV, has about 200 entities for his DXCC, and is an IOTA island chaser. He worked EAØJC twice; once the first operator was HM Juan Carlos, and then the second time, it was operator Jose. Enrique is a member of the EA DX Club and he also has a nice QSL card.

The next amateur to visit was Augusto EA5CTU (**Photo P**) in Alzira. A building construction foreman, he was licensed in 1987. His 45-foot-high tower sits on a roof 96 feet from the ground and supports a 3-element yagi for 10-15-20 meters made in Spain by Tagra, a rotatable rigid dipole for 10-15-20-40 meters, a 17-element yagi for 2 meters and a 21-element yagi for 70cm, both horizontally polarized, and a vertical for 2 meters. Augusto has a TS-940S, a TS-440S, a TS-140S, an Ameritron AL-811 1 kW amplifier, and two US military surplus 2 kW amplifiers. For VHF-UHF, he has an FT-736R and a TS-711E. He works SSB, SSTV, has packet, DX cluster, E-mail, and used to operate on satellites. He has 310 DX entities and a big bunch of awards. Augusto has two types of QSL cards. One of them has the motto: "Ser Espanol: Un orgullo. Ser Valenciano: Una gracia. Ser Radioaficionado: Un deber," which translates somehow into "To be Spanish, it's a pride. To be Valentian, it's a gratitude. To be a radio amateur, it's a necessity." Nice thoughts!

It is interesting that several hams just could not smile when I photographed them. One said: "I am serious person, I don't smile!" I was wondering what a serious person is doing when he is being tickled, but I did not try to find out.

The next amateur to visit was also in Alzira, spelled by some as Alcira. He was Julio EA5GHK, a police inspector licensed in 1985. He did not look at all like the Pink Panther but he was a real inspector — he showed me his badge. He has an H6-type of Butternut vertical, an IC-735 for low bands, and a DR-599 for 2 meters. Julio works SSB, does computer logging, is a DXer with over 200 entities, has over 400 awards, and 4–5 types of QSL cards. He worked the first operator, HM Juan Carlos EAØJC.

The last one in Alzira was Rodolfo EA5APH, a retired radio and TV serviceman, licensed in 1977. He has a vertical antenna for 10-15-20 meters, a dipole for 40 and 80 meters, and a vertical for 2 meters. His rig is an IC-735,

Continued on page 58

Calendar Events

Listings are free of charge as space permits. Please send us your Calendar Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the March 2001 issue, we should receive it by January 31, 2001. Provide a clear, concise summary of the essential details about your Calendar Event.

JAN 20

ST. JOSEPH, MO The Missouri Valley ARC and Ray-Clay ARC will sponsor their 10th annual Northwest Missouri Winter Hamfest, 8 a.m.–3 p.m., January 20th, 2001. The event will take place at the Ramada Inn, I-29 and Frederick Ave. (exit 47 on I-29). in St. Joseph MO. Special room rates are available for Hamfest participants. Talk-in on 146.85 and 444.925. VE exams, major exhibitors, and flea market all indoors. Free parking. Admission is $2 each, or 3 for $5 in advance; $3 each, or 2 for $5 at the door. Pre-registration requests received after Jan. 5th will be held at the door. Swap tables are $10 each for the first two tables. Commercial exhibitors welcome, write for details: *Northwest Missouri Winter Hamfest, c/o Neal or Carlene Makawski WBØHNO/KAOIKS, 3704 Meadowoak Lane, St. Joseph MO 64503. Tel. (816) 279-3406; E-mail [nem3238@ccp.com].*

JAN 21

HAZEL PARK, MI Hazel Park ARC's 35th Annual Swap & Shop will be held at the Hazel Park High School, 23400 Hughes St., Hazel Park MI. Open to the public 8 a.m.–2 p.m. Plenty of free parking. General admission is $5 in advance or at the door. Tables $14; reservations for tables must be received with check. No reservations by phone. Talk-in on 146.64(-), the DART repeater. For more info about the swap, tickets or table reservations, mail to *HPARC, P.O. Box 368, Hazel Park MI 48030.*

JAN 28

CICERO, IL Wheaton Community Radio Amateurs' Midwinter Hamfest will be held 8 a.m.–1 p.m. at the Chicago Motor Speedway, 3301 S. Laramie, Cicero IL. Flea market tables, commercial booths, VE exams on site, free parking. Talk-in on 145.390. Tickets $5 in advance, $7 at the door. For further info call *(630) 545-9950, or E-mail [info@wheaton-hamfest.org].* Advance orders must be received by January 1st. Orders received after this date will be returned unprocessed. Make checks payable to W.C.R.A. and mail with a business size SASE to: *W.C.R.A., P.O. Box OSL, Wheaton IL 60189.*

DOVER, OH The Tusco ARC Hamfest will be held January 28th at Ohio National Guard Armory, 2800 North Wooster Ave., Dover OH 44622, 8 a.m.–1 p.m. Dealer setup at 6 a.m. Admission $3 donation at the door. Dealers admitted free. Tables $10 each. Food will be available on site and the restaurant next door opens at 7 a.m. For additional info and to reserve tables, contact *Gary Green KB8WFN, 32210 Norris Rd., Tippecanoe OH 44699. Tel. (740) 922-4454; E-mail [kb8wfn@tusco.net].*

FEB 5

SUN CITY, AZ An Amateur Radio Equipment Auction will be conducted at 7 p.m. by the West Valley ARC at St. Clement of Rome Catholic Church Social Hall, 15800 Del Webb Blvd., Sun City AZ, (1/2 mi. S of Bell Rd.). Free admission. The club keeps 10% on equipment sales. Talk-in on 147.30(+). Contact *Ron K6OP, (623) 546-5710; E-mail [ronk6op@juno.com].*

FEB 9–11

ORLANDO, FL The Orlando Hamcation Show and ARRL North Florida Section Convention will be held Friday, February 9th, noon to 8 p.m.; Saturday, February 10th, 9 a.m. to 5 p.m.; and Sunday, February 11th, 9 a.m. to 3 p.m. The Orlando ARC will sponsor this event at the Central Florida Fairgrounds, Rt. 50 Colonial Dr., 3 miles west of I-4. Special features include Guest Speaker Ed Petzolt K1LNC, the 1999 ARRL International Humanitarian Award winner. Forums: DX, satellite demos, Phase 3D, PSK-31, APRS. 150 commercial booths, 400 swap tables, the largest tailgate in the southeast, and RV camping with elect. and water, $16 per night. VE exams, must register in advance; call *Gil Lineberry at (407) 843-4122.* Register for the Foxhunt by 4 p.m. at the info booth. Admission $7 in advance or $9 at the gate. Talk-in on 146.760. Check the Web site for up to date info, [www.oarc.org/hamcat.html]. Contact *Ken Christenson, 5548 C Cinderlane Pky., Orlando FL 32808; (407) 291-2465; or [af4zi@juno.com].*

FEB 24

LA PORTE, IN The LPARC Cabin Fever Hamfest will be held Saturday, February 24th, at La Porte Civic Auditorium, 1001 Ridge St., La Porte IN, 7 a.m.–1 p.m. Chicago time. Admission $5, tables $10 ea. Talk-in on 146.52 and 146.61(-) PL 131.8. For info, contact *Neil Straub WZ9N, P.O. Box 30, La Porte IN 46352; tel. (219) 324-7525; E-mail [nstraub@niia.net].* Visit the Web page at *[www.geocities.com/k9jsi/].*

FEB 25

HICKSVILLE, NY The LIMARC Winterfest 2001 Electronics Hamfair and Flea Market will open at 9 a.m. for buyers, with doors opening at 8 a.m. for vendors. The event will be held at Levittown Hall, 201 Levittown Parkway, Hicksville NY. Tables are by advance reservation only; $20 if received by February 14th, $25 after. *Payable to LIMARC, P.O. Box 392, Levittown NY 11756.* Each reservation includes one 6 ft. table and admission for one person. General admission is $6, children under 12 admitted free if accompanied by a paying parent. For more info visit the LIMARC Web site at *[http://www.limarc.org]*, or call the 24 hour info line at *(516) 520-9311.* Talk-in is on the 146.850 rptr., PL 136.5.

SPECIAL EVENTS, ETC.

NOW THROUGH FEB

SAN JOSE, CA Some members of "The Crystal Set Radio Club" [http://clubs.yahoo.com/clubs/thecrystalsetradioclub], a very active Yahoo! clubs on-line discussion group forum, are sponsoring a Crystal Radio Building Contest. This contest is now underway, and runs through February, 2001. The contest objective is to demonstrate innovation and craftsmanship in the design and construction of homemade crystal radios. The contest is open to everyone worldwide. There are two classes of entries, Master and General, and three categories of design: General, 100% Homebrew, and Free Style. A contest Web site has been set up where you can find the detailed rules and information at *[http://w3.one.net/~charlie/contest/].* A distinguished panel of judges has been assembled to judge the contest entries. Short biographical sketches are posted at the contest site. Each judge has had extensive experience in several areas of vintage radio and crystal set design and construction. Prizes, which have been donated by various individuals, include an unbuilt MRL-2 Crystal Radio kit, and a pair of vintage headphones. A FAQ page linked with the Building Contest site should answer most questions that might come up. It is updated as new questions come in. Hard copy information

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Simple P.S. Add-Ons	Enhance your power supply project	Specht	NOV 55
The Care and Feeding of NiCds	Clever tips, plus a home-brew charger.	K9TRG	MAR 21

QRP

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Super-Simple 80m Fox	QRP rig, for dual-band foxboxes.	KØOV	NOV 24
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Satellite Operation, EME, Space

Cruising for Satellites	This is the best of both worlds	W5ACM	OCT 22
From Russia, With Satellite	"The name is Brown, Jerry Brown"	R3/K5OE	OCT 27
Hamsats	You Can Make Hamsat Contacts *Now*	W5ACM	J/F 57
Hamsats	Contacting AO-27	W5ACM	MAR 42

NEVER SAY DIE

continued from page 4

Hmm, and how interesting will the contacts be? Will you QSL yourself? For that matter, what proof will there be?

Loop Antennas

Joe Carr K4IPV has authored a 133-page 8.5- x 11-inch book which has everything and a half that you'll ever want to know about loop antennas. It covers desktop loops, yard-filling loops, and room-sized loops for the antenna-challenged. Loops for any band.

Sure enough, there on page 36 was the Bi-Square Loop antenna. That's the one Sam Harris W8UKS out in Cleveland used to work all around the world on 75m with his Collins 32V, running 120 watts input on AM. When I'd get on with my cool kilowatt and a dipole the guy Sam was talking with in South Africa would say, Let's standby, I hear a faint heterodyne, so someone may be wanting to join us.

The book is $20. If your ham store doesn't have it in stock you can get it from Universal Radio for $2 s/h, 6830 Americana Pkwy., Reynoldsburg OH 43068 [www.DXing.com].

A Basic Decision

There are three fundamentally different career paths for youngsters to pursue in life, and the education for each of these is quite different. Thus, schools (and colleges in particular) should decide for which path they are going to prepare their graduates.

Having been consulted by several college presidents, having interviewed a few more as part of my work with the Educational Subcommittee of the New Hampshire Economic Development Commission, and having read several shelves of books on education, I'm convinced that neither the public nor educators have considered this concept. And that's resulted in a massive waste of time and money for students, faculty, and schools.

The three career paths? One path is in preparing for a job. The second is preparing to own one's own business. And the third is in the arts, as a creator or a performer — like actors, playwrights, artists, musicians, composers, and so on.

There are many things all three career paths have in common, such as a need to be able to read and write, a knowledge of history, and basic math skills.

Business owners in high-tech fields will need to have a good background in math and physics. But from there it should be their personal interest which dictates whether they are going to specialize in electronics, computers, radio, chemistry, biology, and so on.

This is a particularly difficult time for school administrators who have the responsibility for planning ahead. The world changed enormously when the agricultural revolution

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Andy MacAllister W5ACM
14714 Knights Way Drive
Houston TX 77083

AMSAT 2000 Space Symposium

Nearly 200 satellite enthusiasts traveled to Portland ME for the AMSAT 2000 Space Symposium and General Meeting in late October. With the launch of Phase 3-D only weeks away, enthusiasm was high. Many of the presentations focused on the design, construction, launch campaign, and proposed use of Phase 3-D.

One delightful surprise was the release of an updated version of InstantTrack from Paul Williamson KB5MU. Although it is still DOS software, the new version (Rev. 1.50) is Y2K-compliant and, as before, screamingly fast on all PCs. You can get yours on-line via the AMSAT Web site [http://www.amsat.org].

Friday

The AMSAT 2000 Space Symposium and Annual Meeting began in earnest at 8:15 on the morning of Friday, October 27th, with introductory remarks from Symposium Chairman George Caswell, Sr. W1ME. Keith Baker KB1SF followed with an update on the proposed launch schedule for AMSAT's largest satellite ever, Phase 3-D. While AMSAT is involved in many projects, Phase 3-D represents the culmination of many years of dedicated effort by supporters worldwide. The October 2000 issue of *73 Amateur Radio Today* carried several articles dealing with ground station requirements and satellite specifications.

The first presentation of the symposium was a group effort from Dick Jansson WD4FAB, Lou McFadin W5DID, Dick Daniels W4PUJ, and B'dale Garbee KBØG. Dozens of pictures were shown from the early stages of the launch campaign in Kourou, French Guiana.

AMSAT volunteers from many of the participating global AMSAT groups have traveled to Kourou to take care of final integration and testing efforts prior to flight. Some of the pre-launch activities that were shown and described included transmitter testing, solar panel installation, and fueling. Anticipation and excitement was pervasive among the presenters and Symposium participants.

Ed Krome K9EK followed with his talk "Phase 3D: A Primer on High Frequency Operation." Ed discussed cost-effective methods of building hardware from kits to operate through the UHF and microwave transponders on the satellite. There are several sources of reasonably priced receive and transmit converters on the market including offerings from Down East Microwave [http://www.downeastmicrowave.com] and SSB Electronics USA [http://www.ssbusa.com]. Ed talked too long for the symposium organizers, but the audience never noticed.

Dominick "Dee" Interdonato NB2F addressed proposals for projects beyond Phase 3-D. His idea for Phase-5 included both orbiters and landers traveling to the moon and the planets. While the means to achieve such a program is currently beyond AMSAT, it was truly thought-provoking. How about an Amateur Radio Planetary Package (ARRP) as a "piggyback" payload on a NASA or European launch?

G. Gould Smith WA4SXM presented findings on his research into 9600-baud digital operations via satellite using several types of antennas. His results showed that most simple antennas, like omnidirectional "eggbeaters" yielded low digital downlink efficiencies compared to small yagi antennas, even when using good preamplifiers at the antenna.

Every year we see more projects from university groups. Three students from the Thayer School of Engineering at Dartmouth College captivated the group with their paper "Modular Nanosatellites as Amateur Radio Communication Platforms." They are developing their version of a CUBESAT, a small 2.2-pound satellite measuring only four inches on a side.

Augustus Moore provided an overview of the program to develop a common bus structure nanosatellite that could be easily adapted for various communication and science projects. Todd Kerner KB2BCT, a ham since age 14, provided technical details on the internal systems. Amish Parashar KE6EZM described the antennas for the basic two-meter and 70cm satellite.

While Bob Bruninga WB4APR usually provides a focus on digital communication topics and APRS, his first AMSAT 2000 Symposium presentation was for a microsat-style satellite carrying a linear transponder with a 10-meter uplink and a two-meter downlink, the inverse of what we commonly call Mode "A" (2 meters up and 10 meters down). His premise was that 10-meter transceivers and two-meter receive converters are inexpensive compared to ground equipment

Photo A. Chairman of the AMSAT 2000 Space Symposium and Annual Meeting, George Caswell Sr. W1ME.

Photo B. Chuck Duey KIØAG makes contacts via UoSAT-OSCAR-14 while Bruce Paige KK5DO logs at the AMSAT gathering in Portland ME.

Photo C. Ernie MacLauchlan K1ELA checks out the HF bands from the AMSAT Space Symposium Special Event Station (QSL via KK5DO) using the AMSAT callsign W3ZM.

needed for Mode "A". Bob also proposed an in-band 10-meter repeater in orbit. This would be even easier to use. While a 10-meter uplink is not currently authorized, it would be worth consideration to change the rules governing this allocation.

Following lunch, the programs continued with more CUBESAT information from Prof. Bob Twiggs KE6QMD of Stanford and Cliff Buttschardt K7RR. Bob is working with over 20 groups to develop various types of the four-inch-on-a-side CUBESATS that can be easily deployed by a larger launcher satellite.

Chuck Duey KIØAG provided a lively talk on tricks, hints, and tips for portable satellite operation. Chuck makes it look easy. He has operated from remote locations all over North America, handing out new grid squares as he goes.

The nature of the presentations became more technical and esoteric when Dr. Tom Clark W3IWI brought the audience up to date with advances in the Global Positioning System (GPS) world. Tom has been experimenting with extremely accurate GPS receivers that are capable of time measurements less than a nanosecond. Some Internet sites to check for details include [http://tac.ggao.nasa.gov] and [http://gpstime.com].

Photo D. Prof. Bob Twiggs KE6QMD of Stanford showed some of the prototype gear for launching CUBESATS.

After a short break, Matt Ettus N2MJI explained his concept of a spread-spectrum wideband transponder for the International Space Station. The focus of his system is to create a system that would provide varying levels of service, depending on the complexity of the ground station, for paging, digital voice communications, video, and high-speed data transmission.

Tony Monteiro AA2TX came with an update to his already-successful InstantTune software for automatic frequency control of the Yaesu FT-100 Field Commander for satellite operation. The software can be downloaded from AMSAT's Web site, [http://www.amsat.org]. Go to the section under InstantTrack Utilities.

Even more exotic than these high-tech talks was Dr. Paul Shuch's (N6TX) explanation of the efforts of the SETI League (Search for Extraterrestrial Intelligence) to use the processing power of thousands of computers around the world to processed digital data from radio telescopes to find evidence of life elsewhere in the universe. It's called "SETI at Home."

The technical presentations didn't end with dinner. Evening talks were provided by Gould Smith WA4SXM with an introduction to amateur-radio satellites, and a parallel set of sessions featuring more from Paul Shuch N6TX, Bob Twiggs KE6QMD, Prof. Gil Moore on Project Starshine, and Peter Heard on Aerospace Science in schools and the home.

Saturday

Randy Kohlwey N7SFI was the first presenter on Saturday morning. He brought details on the payloads that are being built to fly on the new OS-II satellite being developed by One-Stop Satellite Solutions (OSSS). After providing information about the high-speed data-communication capabilities of the satellite, Randy gave details on ground-based hardware and software that users would need to receive the S-band (2400 MHz) downlink running at 153,600 bps. His paper in the proceedings gave a number of excellent sources for further study.

Dick Jansson WD4FAB followed with "So You Want to Build a Satellite." Dick has been a key player on mechanical and thermal hamsat design work for many years. Phase 3-D work has been a 10.5-year project. Phase 3-D will not be duplicated anytime soon, but the lessons learned will provide direction for future satellites. Dick proposed a simpler approach for future AMSAT satellites that will provide DX opportunities, no internal propulsion systems, cost no more than $500,000, and weigh less than 50 kg. Phase 3-D weighs in over 600 kg, and has been quite expensive in both human and financial resources.

Dick went on to describe, with overhead slides and commentary, his vision of Phase 3-E. The satellite could be either similar in shape to Phase 3-D or more rectangular (depending on launcher requirements), but much smaller (about 36" wide and 18" high), and without the extendable solar panels.

The physical design would target a launch on an ASAP-5 platform (a ring around the lower part of the primary satellite for small experimental satellites) on an Ariane 5 rocket. High-efficiency transmitters and an

elliptical orbit to provide wide coverage from apogee (the high point of the orbit) would be needed, along with a short project life on the order of three years.

Bob Bruninga WB4APR came back for a second presentation to the AMSAT 2000 Space Symposium. He has been actively pursuing methods of providing APRS operations via satellite. Bob would like to see a hamsat that would provide easy mobile or hand-held access from anywhere on earth. While the current terrestrial APRS network is accessible from most population centers, the goal is to extend connectivity to allow short messages to be sent globally.

Bruce Paige KK5DO updated the symposium attendees on activities associated with the Houston AMSAT Net. Unlike other local or even HF information nets, coverage for the Houston net is global. Using a geosynchronous commercial satellite link for North American coverage and a live Real Audio feed for everywhere else, the net has become a prime source of information for those that like to listen to the interactive discussions that ensue between W5ACM, KK5DO, WD5DZC, and K5OE. You can get all of the details online at [http://www.amsatnet.com]. The Web site also has Real Audio recordings of all of the Space Symposium presentations.

We are looking forward to significant amateur-radio activity from the International Space Station. Frank Bauer KA3HDO and Will Marchant provided a complete description of the systems that have been sent to ISS and those that are planned for the future. While the initial gear is similar to items carried on the shuttle under the SAREX program (Shuttle Amateur Radio EXperiment) for VHF/UHF analog and digital communications, future plans include HF and microwave gear and specialized modes like Slow Scan TV (SSTV) and Fast Scan TV (FSTV). As negotiations continue with NASA, the system configurations are in a state of flux. You can keep up with everything via the Internet at [http://ariss.gsfc.nasa.gov].

Steve Bible N7HPR was not available to discuss his paper on a PIC-based Rotor/Radio Controller Interface, but Keith Sproul WU2Z had related information on software that works in conjunction with the hardware.

Keith presented his paper "APRS and the TAPR Easy Trak." This az/el rotator control system provides an interface for computer-controlled satellite tracking when used with popular tracking software, or provides a number of manual and automated features such as automatic balloon tracking (or other airborne devices), when latitude and longitude data is available from GPS data from the payload. Check out the TAPR Web site [http://www.tapr.org] for hardware information on "Easy Trak."

AMSAT Executive Vice President Robin Haighton VE3FRH opened the Saturday afternoon presentations by reading new E-mail updates directly from Kourou with information on Phase 3-D and the launch status. Various members of the team that have been to Kourou for early parts of the launch campaign followed with more pictures and descriptions of the facilities and satellite checkout procedures at the European Space Agency's South American launch complex.

Ken Ernandes N2WWD has been developing pre-launch element sets for hamsats and shuttle flights. His paper "Estimating Keplerian Elements for New Satellite Launches" provided insight into the methods he uses to provide these predictions.

Ms. Itziar Martinez covered a very technical paper promoting a new design of the G3RUH software modem for high-speed digital communications. Innovations in the synchronization algorithm and filter design have promise of providing improved modem performance.

All of the papers presented at the Space Symposium are available in the *Proceedings of the AMSAT-NA 18th Space Symposium and AMSAT-NA Annual Meeting*. This 192-page document can be obtained from AMSAT. Check the Web site [http://www.amsat.org] for contact information.

After a short break, the yearly AMSAT General Meeting followed. This was an opportunity for AMSAT members to ask questions of the officers and Board of Directors members. Other Saturday evening events included the Annual Banquet, Awards Presentations, and prize drawings. The Grand Prize this year was a Kenwood TMD-700A digital/analog mobile transceiver. During the banquet, the speaker was R. Cargill Hall, Chief Historian of the National Reconnaissance Office. Did you know that OSCAR-1 went to space as ballast on a spy-satellite launch?

Sunday and More

Once every year AMSAT's Area Coordinators have an opportunity to meet with each other in person. At the AMSAT gathering it has been traditional to have an Area Coordinators' Breakfast early on Sunday morning after the completion of the Symposium, General Meeting, and Banquet. They share experiences and information regarding their individual efforts to give talks to clubs, run booths at hamfests, promote net activity, and advertise the existence of AMSAT and the hamsats.

Photo E. *A poolside Fuji-Oscar-29 pass with Chuck KIØAG and Bruce KK5DO, while Todd KB2BCT, Amish Parashar KE6EZM, and Gould Smith WA4SXM look on.*

Following the AC meeting, Russ Tillman K5NRK chaired the AMSAT Strategy Workshop. While the group knows that the focus of the organization has been, and will

Photo F. *Keith Sproul WU2Z demonstrated a new az/el rotator control system from the Tucson Amateur Packet Radio Society (TAPR).*

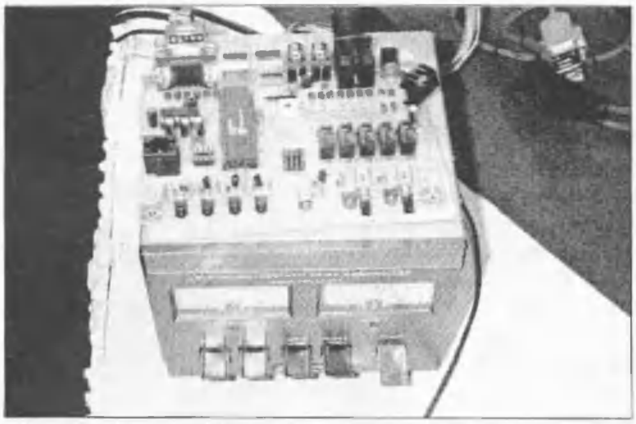

Photo G. Close-up of the Easy Trak computer-to-rotator interface hardware from TAPR.

continue to be, on Phase 3-D, the question, "Where do we go from here?" needs attention.

Although many of the Phase 3-D volunteer designers and builders are tired, many others are already moving on to new ideas and projects. Just a few of the proposed strategies of AMSAT, the organization, include enhancement of user-oriented operations, mentoring to educational and other organizations, exploitation of Phase 3-D as a resource, and the promotion of worldwide amateur-radio satellite coverage. During the Strategy Workshop, many other possible future goals and projects came to the floor. One key point was clear: If you don't know where you are going, it doesn't matter how you get there.

In the past, AMSAT's projects have been driven by launch opportunities. This will not change, but the focus of the payloads, digital or analog, low VHF or exotic microwaves, experimental telemetry or communications, will be based on what the core enthusiasts, both users and builders, want.

The AMSAT Board of Directors meeting convened on Sunday afternoon. The first order of business was to elect officers. Keith Baker KB1SF did not wish to serve another term as president due to personal obligations. Keith has done a superb job of leading the organization in recent years. Robin Haighton VE3FRH was unanimously elected as the new president of AMSAT. Ray Soifer W2RS, one of the founders of AMSAT, was elected as the executive vice president.

The typical meeting takes nearly two days, and this year was no exception. Agenda topics are discussed until a consensus is reached. This takes time due to the diverse personalities of the board members. Issues addressed included the significant financial drain of Phase 3-D and the impact on the year 2001 budget, future projects, field operations, publications, support for International Space Station ham-radio operations, and numerous administrative matters.

AMSAT currently stands at a crossroads. Phase 3-D has been the largest project to date. It's time to review the lessons learned from the experience and move forward to the new challenges and opportunities of this first decade of the 21st century.

Photo H. At the AMSAT Annual Banquet, the guest speaker was R. Cargill Hall, Chief Historian of the National Reconnaissance Office.

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A New Millennium for Foxhunting

Am I the only writer who hasn't used the "M" word in the last two years? There hasn't been good reason to until now, as it was not until this issue that 73 Magazine and ham radio officially entered the third millennium A.D. It's an exciting time for our hobby, especially for hams who like on-foot hidden transmitter hunting under international rules, which goes by the names foxhunting, fox-tailing, radio-orienteering, and ARDF.

For the second time, stateside hams have traveled to compete in the World Championships of ARDF. The last ARDF Championships of the second millennium were October 13-18, 2000, in Nanjing, China. As I write this, most of the twelve Team USA members (in **Table 1**) have just returned from the trip. Two are still in China on an extended tour. All are eager to tell their experiences to other hams, in hope that Team USA for the next Championships will be bigger and better.

Although there was no real-time reporting of the events, the Internet provided the next best thing. But I'm getting ahead of the story. First, as background, I should mention that ARDF World Championships host usually provides low-cost housing such as barracks and hostels. All competitors pay a fee (typically US$200) that includes lodging and food for five overnights as well as local transportation, a tour, and admission to the events. The only extra charges are for the closing banquet (about $15) and transportation to/from the airport.

For the 1998 World Championships in Hungary, competitors were housed in dormitories of a teacher's institute. What would the facilities be this time? Surprise! Everyone stayed in the Jiangsu New Century, a four-star luxury hotel on Xuanwu Lake with 324 rooms and suites. According to its brochure, all rooms are equipped with "DDN high speed optical data line." The facility also features a swimming pool, tennis court, gym, game room, bowling alley, and dancing hall.

Five nights of this plus participation fees for just $200? How did they do it? More important, how can the USA ever put on such an event at a similar price?

Americans in demand

The hotel was indeed beautiful (see **Photo A**), but the Internet features weren't universal. According to Bob Frey WA6EZV, "The

Continued on page 50

Name	City/State	Division
Dick Arnett WB4SUV	Erlanger KY	Old-timer
Bob Cooley KF6VSE	Pleasanton CA	Veteran
Robert Frey WA6EZV	Cincinnati OH	Old-timer
Dale Hunt WB6BYU	Yamhill OR	Jury
Marvin Johnston KE6HTS	Santa Barbara CA	Old-timer
Harley Leach KI7XF	Bozeman MT	Veteran
Karla Leach KC7BLA	Bozeman MT	Veteran
Jack Loftin KC7CGK	McMinnville OR	Senior
Gyun Nagy HA3PA	Melrose MA	Senior
Jay Thompson W6JAY	Santa Ana CA	Junior
Richard Thompson WA6NOL	Santa Ana CA	Trainer
Csaba Tiszttarto	Staten Island NY	Senior

Table 1. Team USA members.

Photo A. ARDF World Championship participants were housed in the 4-star New Century Hotel. A giant red banner in front proclaimed the events. (Photo by Dick Arnett WB4SUV)

New Products

Free On-Air Code Learning Instructor Cassettes

Morse Code instructors may hold their code-learning classes over their local repeater or simplex frequencies with free code-learning cassettes from Gordon West WB6NOA. Each cassette is 90 minutes long and recorded monaurally for easy player-to-microphone pickup.

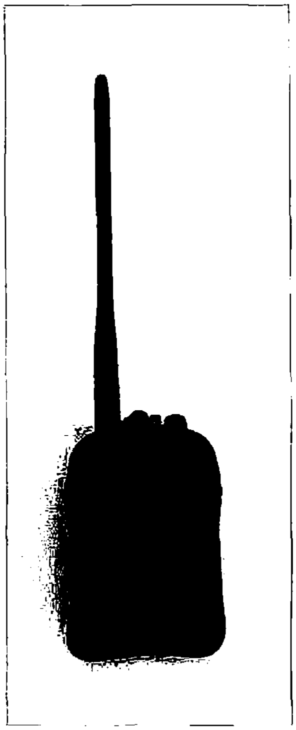
"All of the code-learning practice is narrated, and these audio cassettes are ideal for instructors to play over their local repeater system," comments West, well-known for his innovative amateur radio teaching methods and materials.

"Instructors may also use these cassettes in the classroom, too, working in live code off the air as well as for additional code practice using computer programs or a set of paddles," adds West.

CW instructors may receive these cassettes at no charge by including a brief letter describing their upcoming on-air or in-class scheduled code course, as well as 10 first-class stamps for Priority Mail delivery.

"These free training cassettes are part of the Ham Ambassador program, and I encourage all instructors and repeater control operators to take advantage of this unique teaching opportunity," concluded West.

Send your request and class details to: Gordon West Radio School, 2414 College Drive, Costa Mesa CA 92626.



The Hold-It NEO™

Finally, a neoprene pouch that looks professional. Those PowerPort designers have taken the leap from leather to high-cushion neoprene. We got ours in Can't-Lose-It Red, but for the more subtle among us, they also carry it in Covert Black.

The Hold-It NEO has a great look, with all edges fully finished. When you wear your radio all day, every day, it gets quite a bit of abuse. The NEO gives ample coverage and shock absorbency to protect it from the day-in, day-out hazards you always seem to run into.

In talking with the folks from Cutting Edge, we were happy to find out that they have NEO models to fit many radios, and even one in the works to hold those new FT-817 QRP radios from Yaesu. We'll keep you posted. MSRP: $14.49 and up.

For further information, contact Cutting Edge Enterprises, 1803 Mission Street, Suite PMB-546, Santa Cruz CA 95060; tel. (800) 206-0115; E-mail [info@powerportstore. com].

Mini-News from MFJ

• MFJ's model MFJ-434 contest voice keyer sends your call and does contest exchanges for you in your own natural voice. You can record and store up to five messages for a total of 75 seconds, as well as repeat them if desired and even vary the repeat delay from 3 to 500 seconds. Transparent to your mic, so your mic's characteristics don't change when it's installed. SMT technology. MSRP: $179.95. Uses 9V battery, 9–15 VDC, or 110 VAC with optional MFJ-1312B cord ($14.95). MFJ-73 remote/computer control head with cable, $29.95.

• The MFJ-297 professional-grade desk mic is designed for ham radio communications where speech intelligibility makes a difference. Frequency-tailored to bust through QRM and noise; choice of DX punch or broadcast quality audio; Sibilant Sound Shield lets you talk close to minimize background noise but still not have distracting hiss. Many more features, including 11-inch boom. MSRP: $69.95.

• MFJ's professional-quality MFJ-394 single (left) ear boom mic lets you keep your hands free for contesting, DXing, traffic nets, and mobile operation. Leatherette padding and headband, 1/4-inch headphone jack, 3.5mm mic jack. MSRP: $74.95. For cables, please inquire.

For further information, please contact MFJ Enterprises, Inc., P.O. Box 494, Mississippi State MS 39762; tel. (800) 647-1800; fax (662) 323-6551; E-mail [mfj@mfjenterprises.com]; Web [www.mfjenterprises.com].

15m CW Transceiver Kit

Oak Hills Research has announced a new addition to its line of QRP transceiver and accessory kits — a 15m version of the OHR 100A QRP CW transceiver.

Available for 15-20-30-40m, the OHR 100A has an enviable reputation for ease of building, performance features, and operator convenience at the reasonable MSRP of $129.95 (can also be built to order). Alignable for General or Novice, it puts out 4–4.5 watts of RF.

Major features include: 5W out on each band (4–4.5 on 15); ultrastable premix VFO; RIT with range of +/- 1 kHz; 4-pole IF filter; true sine wave sidetone; silky smooth QSK (optional internal electronic keyer is available); precision VFO tuning pot; much more.

For further information, contact Milestone Technologies, Inc., 2460 South Moline Way, Aurora CO 80014-1833; tel. (800) 238-8205; E-mail [hq@MorseX.com]; Web: [www.MorseX.com].

Photo B. Team USA 2000 poses behind the flag at the opening ceremonies in Nanjing. Left to right in back row: Jack Loflin KC7CGK, Gyuri Nagy KF6YKN, Jay Thompson W6JAY, Richard Thompson WA6NOL, Csaba Tisztarto, and Bob Cooley KF6VSE. Front row: Karla Leach KC7BLA, Harley Leach KI7XF, Marvin Johnston KE6HTS, Bob Frey WA6EZV, and Dick Arnett WB4SUV. Dale Hunt WB6BYU (IARU Region 2 Jury Representative) had not arrived. (Photo by Dick Arnett WB4SUV)

Photo C. Each competitor is told his exact start time well in advance. These competitors are checking the time and getting other information such as time limit and frequencies. (Photo by Marvin Johnston KE6HTS)

Homing In

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room I shared with Dick Arnett WB4SUV was one of only a few with Web access. As a result, it seemed that we had the most popular place in the hotel. Three or four others had computers, but most didn't work. It was hilarious, the flow we had in and out, including Australians, Belgians, most of Team USA, and others."

Just as in the Olympics, the opening ceremony of an ARDF World Championships is a major event, with parades, performances, and speeches. All of the teams march in and stand behind their national placards and flags (**Photo B**). "Twenty minutes afterward, the other teams had pretty much broken up and were mingling among the crowds," says WB4SUV. "But our team was still standing together after an hour and a half because people, mostly Chinese, were wanting to take pictures of us.

"As soon as one would finish, another one would come up. They would put their children in front of us, or we would hold a child and stand with the USA flag for them. They were so astonished that we were there. If they spoke English, most of them would ask, 'Are you the champion in your country?' We would have to explain that primarily we were there to learn the sport."

Regular "Homing In" readers remember the difficulty of the World Championship ARDF courses in Hungary two years before. (See the January 1999 issue.) Those who attended both events agree that the Y2K sites were even more arduous. As usual under International Amateur Radio Union (IARU) rules, the Seniors (males ages 18 to 40) had to find five foxes, each transmitting for 60 seconds in sequence. Those in other age/gender divisions had to find four of the five. They had to get to the finish line within 130 minutes or be disqualified (**Photo C**).

"The tough course started right out of the gate on two meters," WA6EZV recalls. "You had to climb 200 meters immediately. Once on top of the ridge line, you looked out over a huge valley, and up the other side of the valley you saw these little ant-sized people going up a steep hill. It about wiped you out. There was no trail, just straight up the side of the hill.

"The other problem was that a couple of trails ran out," Bob continues. "They may have been there years ago when the map was made, but they're overgrown now. On the way back with just a few minutes before time-out, I hit an area that on the map appeared to be 500 to 600 meters from the finish. Suddenly the trail stopped with no sign of anything to follow. I took a bearing and headed into the woods. Big mistake! I was soon in a jungle so thick that I could hardly maneuver. At that point, I slipped and lost my map board. I recollected myself and realized my glasses were gone, too."

WA6EZV kept going without his glasses and got to the finish a half hour later. Despite his weariness, he managed to sprint over the line. "Then the craziest thing happened," he says. "While I silently lamented my finish, someone walked up to me and asked if I had enjoyed myself. I answered 'Yes.'"

WB4SUV had a similar problem with disappearing trails. "The vegetation in the trail that went blank on me got so thick that literally I could not see two feet in front," Dick says. "I knew I had to go west to get to the finish and there weren't any other trails on the map going that way, so I just plowed my way through. Suddenly, I found myself at the bottom of a 12-foot cliff looking up. I caught my breath and gathered my senses, then realized that my map was somewhere in the vegetation, not to be found anymore.

"I began plunging my way further and realized that in the fall my receiver had died also. That meant I couldn't use the radio beacon at the finish for navigation. The only thing left was my compass. So I just kept heading west. When I finally popped out onto the big north-south trail that led to the finish, I thought I was to the north, so I went to the left.

"After I went about a mile, I saw in the distance a huge area covered with red-white-and-blue tarps, and some people. The tarps were just like the ones that had been used to impound our radio direction finding (RDF) equipment before we started. I went in that direction through a creek and across rice paddy to get there and then realized it was only a farm that had tarps on the equipment. So I had to I backtrack. If I had gone right on the main trail, I would have been only about 100 yards from the finish."

A Second Chance

After a day of rest and touring, it was time for the 80-meter competition. Weather was very rainy, so organizers increased the time

limit to 140 minutes. All Team USA members decided on a much more conservative game plan this time. As a result, no one went overtime and all but two posted a much better time than on two meters.

"Every time you went under a bamboo tree and brushed it, you got soaked," says WA6EZV. "It was as if somebody turned a bucket over on you. We got so wet that we didn't care any more. Fortunately, it wasn't cold. Actually, the temperature was great for running."

According to Dale Hunt WB6BYU, the trails turned into thick mud (**Photo D**). "Most competitors' shoes got covered with it," he says. "By the time we got back to the hotel, they were using a special entrance for us with the red carpet rolled out, just to collect the mud. Then we had to take off our boots and put on slippers to protect the floor. But the earlier arrivers had already messed up the front entrance. The following morning, they had bedsheets out on the upper floor of our hotel because we had tracked in so much mud.

"The end of the 80-meter finish corridor was wet grass," Dale continues. "You had to stick your card into the machine to determine your official ending time. A lot of people went sliding right by. There was nothing to hold onto because the machines were on a wavy post. A lot of people went 6 or 8 feet past, slipped and fell on their equipment and scrambled back up to go punch their card. I saw one guy break off the sense antenna of his RDF set that way."

One member of our team got almost as wet and muddy as the others, but he wasn't running on the course. WB6BYU had been selected to be the first person from IARU Region 2 (North and South America) to serve on the international jury. This 12-member panel made sure that contestants were properly started and timed. It also verified the results from the electronic scoring system, acted on any protests from competitors, and certified the results of each hunt.

Photo E. Tom Curlee WB6UZZ (left) explains foxhunting to a group of Scouts at JOTA 2000, assisted by Scoutmaster Kent Gardner WA7AHY.

Dale expected to spend the competition hours keeping watch over one of the fox transmitters in the forest, but the Jury Chairman had another job for him. "I called starting numbers," he says. "Every 5 minutes I told the next competitors to get their maps and gear. They assigned me to that role because I had the best English skills. In European ARDF championships, the jurors are expected to have fluent English, because it's the official language. But that was not the case here. They had me calling names and numbers because I could pronounce them, and if somebody had a question I could answer or know what to do about it."

Of course all participants got a good taste of China, in every sense of the word. WA6EZV remembers, "On the local tour before the 80-meter event, they took us out and served us a classic Chinese dinner at what would be considered a very ritzy restaurant. They brought out lots of little dishes, one or two at a time, including the Pig's Ear, the Coagulated Duck's Blood Soup, the Pickled Duck Eggs, you get the idea."

WB6BYU tells how several team members met the locals. "One of the busses had a flat on the way back from the 80-meter event. They were in a tiny village with about three buildings where the citizens aren't used to seeing foreigners. The bus had a spare tire but no jack, so they had to wait an hour for the next bus. They ended up in a little house where they had a wonderful time visiting the occupants, with the help of interpreters, who were English students from the university. Harley Leach KI7XF handed out chocolate bars to the kids, so he got the mud washed off his boots."

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Photo D. Runners start and finish through long corridors so that those waiting cannot get clues by seeing which way they go. This 80-meter corridor turned into a very muddy trail in the rain. (Photo by Marvin Johnston KE6HTS)

Photo F. Two days after returning from the ARDF World Championships, Jay Thompson W6JAY showed Scouts how to take bearings.

ON THE GO

Mobile, Portable and Emergency Operation

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Do YOU Want to Help Out?

When dealing with emergency communications, many hams view the event as a "Come As You Are" party. While it is true that many people are needed in the event of an emergency or disaster, and all volunteers are welcome, there are a number of established organizations that provide the structure around which a response can be built.

How many different types of organizations that hams support can you name? You may be surprised at how many opportunities there are for you to make a difference.

Public Service Agencies: Many police and fire departments utilize volunteers in the event of an emergency either to provide additional communication through the ham bands or to provide additional trained operators on their own systems. Many times these operate independently of other disaster services. In other cases, in the event of a major emergency or disaster, all communications support may be centrally coordinated through a state or county agency to ensure that the various requests are adequately prioritized and addressed accordingly.

Social Services: The Red Cross and Salvation Army are virtually synonymous with the word disaster. Organizations such as these provide support for everything from housing for those displaced from their homes to a hot cup of coffee for those working at the scene of the disaster. While these may be the best known throughout the country, there are other worthy groups who may be active in a particular area. Recently there has been an increased focus among local churches to set up facilities to assist in an emergency. In fact, some pastors have begun to offer ham radio classes at their churches as a way of ministering to those in need!

RACES: The Radio Amateur Civil Emergency Services (RACES) was founded in 1952, initially in response to the emergence of the Cold War following World War II. By definition, RACES provides communications to local or state civil-preparedness agencies. Originally this was perceived to be a wartime requirement in support of Civil Defense, but later was extended to other types of emergencies. Ham radio operators must be registered with the local civil-preparedness agency having jurisdiction to operate as a RACES station. In essence, RACES exists to support declared emergencies and in the event that the President would invoke the War Emergency Powers Act, non-RACES amateur stations could be prohibited from transmitting and RACES stations could be limited to certain frequencies. The FCC used to issue licenses specifically for RACES, but that no longer is true.

ARES: The Amateur Radio Emergency Service is similar to RACES in many respects. Some people see the two as competitive and try to pick sides, but the two actually work in concert with one another. RACES has some specific limitations. It can only operate in a declared emergency except for drills that are limited to one hour per week. ARES does not have any such limitations; in fact, holding dual membership permits a smooth transition during an emergency before it is declared by the civil-preparedness agency and after. Before the declaration, everyone can operate under ARES coordination and upon declaration, as RACES stations.

REACT: Radio Emergency Associated Communications Teams were once associated only with Citizens Band operators. As time has passed, though, this has expanded to include GMRS (General Mobile Radio System), cellular telephone, and amateur communications. Many times REACT acts not only as another emergency service, but also a pool for potential hams.

SKYWARN: While SKYWARN is usually involved in a developing disaster rather than in disaster support, it is such an important function that I have to include it. SKYWARN operators are trained by the weather service to report weather conditions. This information is critical to the weather service because it allows the meteorologists to correlate physical weather conditions with their telemetry and radar images. This is usually coordinated through the ham bands, and many weather professionals have become licensed hams because of this important service.

MARS: The Military Affiliate Radio System uses ham radio operators who have been trained in military communications to provide backup, health and welfare and emergency communications in support of the armed services. MARS has defined roles in emergency support that can complement the other amateur radio services. MARS stations operate on frequencies outside the amateur bands as authorized by the cognizant military authority. Their procedures are carefully defined to minimize transmission time and all MARS operators have completed appropriate training programs. Unlike transmissions on the amateur bands which can be monitored and quoted by anyone (including the news media), MARS transmissions are not to be used by those who might hear a transmission. This provides an additional resource for sensitive information such as a list of names of casualties that has at least some degree of protection to ensure confidentiality.

NTS: The National Traffic System provides an organized method of transferring a written message from one location to another by use of various modes and means, including a series of relays from one station to another to ensure the message's delivery to its ultimate recipient. In an emergency or disaster situation, the NTS provides a means for handling health and welfare traffic into and out of a disaster area. Often the first news about a friend or family member's safety has NTS as a key player.

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Makes Me Wanna Stream!

You would think I could make a decision as to what to write about and stick with it, but something a little out of the ordinary happened a few days ago. I was contemplating an SSTV article because I have ignored that area for a year or so. There is a lot going on there and so I was monitoring signals and checking on software availability.

Then I received a minor distress call from a friend about WinWarbler and, as I was tuning across the band from the SSTV area to the PSK31 portal, I heard a strange warble. I had heard this before around the 14.180 neighborhood and had not been able to make sense of it.

This time, I nearly passed it by, but I said something like, "What the heck, one more try will take just a minute." I brought up the copy of Stream from IZ8BLY and fiddled with the tuning until something looked like it was about nailed in the sidewinder waterfall. I had been focusing so intently on the waterfall that when I glanced to the receive panel I was pleasantly surprised to see intelligible print for the very first time since I had downloaded this program.

Now I knew of at least one hangout for the MFSK16 gang. I had heard rumors of different places, but here they were. And, believe me, I did nothing to disturb the comfort of their habitat. I didn't tell them a word about how they were supposed to be anywhere else.

I simply joined the fray and managed to enjoy two memorable QSOs, the first with Tom ND5Y and the second with Bruce VE6ATY. The following day, I had a few more contacts in the same area with this mode and found that most of the hams I was contacting were also just getting started. Strange how we seemingly pounce all at once when the right time comes along. By the time this hits print, this will all be ancient history in ham digital annals.

The screenshot this month is the IZ8BLY Stream software in action as I was working Paul up in Seattle. As you can see, there is considerable area to display the received as well as the transmitted messages for several minutes. This can relieve the strain of having to scroll and look for information that has suddenly disappeared.

But the ingenious part of the display is the waterfall on the right side. In some respects, it takes some getting used to because you have to learn which way to tune to pick up the signal you can hear which is outside the relatively narrow waterfall boundaries. Once you are over this small hurdle, the precise tuning that is necessary for this mode is a piece of cake.

When you bring the mouse cursor into the waterfall area, an arrow appears. Whenever you click your mouse key, the horizontal line represented by that arrow moves instantly to the bottom tuning parallel in the waterfall. In other words, as soon as you spot the bottom edge of the incoming signal crossing the waterfall, move the arrow to that point and click. You are tuned. In a few seconds, print will show up on your screen. Fun!

This is another of the many free programs developed by a devoted amateur for the benefit of the ham community. It can be downloaded from the URL listed in The Chart on the same line as Hellschreiber and MT63, other programs from IZ8BLY. It installs like any good Windows program is expected to install, with a set of on-screen instructions for you to follow.

You will have to make your own start menu or simply go to the directory where you installed the file and double click on the Stream startup file. You will also find in that file the Help folder. I strongly suggest you open that file and print the contents. The Help file does not automatically load on installation.

The program is so intuitive you will find little reason for the Help file once you get up and running, so not having a Help to click on is not much of a disadvantage. However, it is to your advantage to read the Stream Help file all the way through to realize all the features available and how to use them. Also, you will find paths to seek help from other users such as through the MFSK reflector.

You will be a little surprised to realize the Stream software also supports three other modes. The very familiar PSK31 is available, plus a new PSK63F and MFSK8. If that isn't enough, the program contains a command to go into "standby" mode while you bring up any other program to experiment with and compare with the station you are in contact with. Versatility gets redefined.

While I am thinking of some of the new stuff we get to play with in preparation for this column, let me mention a forum speaker I witnessed at the recent ARRL Pacificon convention. He was expounding on some things that sounded a bit outlandish having to do with how we were going to eventually be using a totally different concept in radios.

His first mention was Software-Defined Radios, and then he spoke of Smart Radios that would sense the other users of the spectrum and find ways to interleave amongst those signals to transmit and not cause interference. I sat through this for about ten or fifteen minutes and was about to give up on the lad when, suddenly out of the blue, he said something that connected for me, if not for others.

He mentioned the software control of radios such as we see in Kachina, and also Ten-Tec with their Pegasus. And he referred somewhat to those as being examples of the future radios, I suspect in some embryonic form. Incidentally, if you go [www.Dandin.com] and click on "Reports" you will get a bare overview of the subject. The subject centered on spread spectrum, which hasn't caught my interest as yet. I suppose it is difficult to imagine how you comment

on a 599 signal in that mode — of course we give those reports in PSK31 and think it's cool.

But nevertheless, it got me to thinking. My next step was to take a good look at the Kachina display in the next building and watch the very fancy moves the demonstrator was putting on the lookers-on. I won't say this as yet fit the description of the Smart-Radio-of-the-future, but it is certainly many steps closer than anything such as I use with the knobs on the front of it.

I talk to hams several times a week who are using either of the above-named rigs and they are all very happy with their capabilities. One of the things that is obvious is how easily updates are incorporated. The manufacturer either sells a card to insert or supplies an often-free software update. There is no sending back to the factory for major mods or the need to replace the rig.

I think at this time that my new Icom with the knobs on the front has more flexible filter control and as steep sides on those filters as anybody can build, but there are no simple board or software updates for this kind of rig. If someone really builds something a whole lot better, Icom I am thinking in this case, the upgrade will cost another rig. Something to think about. And all the while we are plugging in little cards in our computers and loading software just like it is the future already when we work with this digital stuff.

And that leads me back to another part of this action-filled day. One of my Pegasus friends, Les WA7HAM, had been using DigiPan on his digital rig and was quite satisfied and then, following a suggestion he claims came from this column, installed WinWarbler. Here he was at a new ball game in a strange new ball park.

I know he liked it immediately. Then he dropped me a line complaining about the display in the waterfall lacking contrast. He felt like his glasses were fogging over and did I have any suggestions?

So, I gave it a bit of thought. Actually that was when the interruption came along and I discovered the MFSK16 above. But I recalled the WinWarbler has some Preference adjustments for the tuning spectrum. If you click the "Config" key and then select the PSK tab in the screen that comes up, you will find many choices to enhance your tuning pleasures. One of them brings the waterfall around to a configuration reminiscent of the DigiPan waterfall. Another brings up a well-defined spectral display.

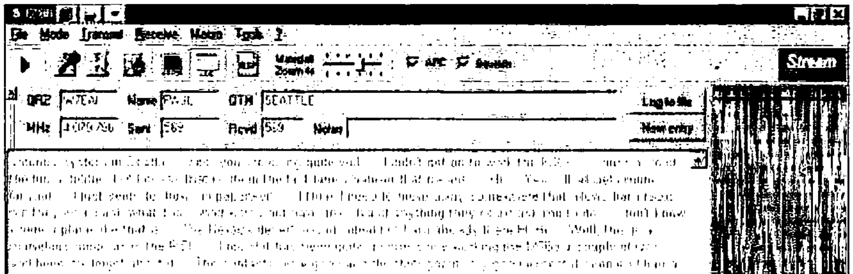

Fig. 1. Screenshot of Stream in MFSK16 mode. This software has a similar intuitive "feel" as with other ham soundcard communications programs, but there are some differences. The panel on the right is the "waterfall" I refer to as a "sidewinder." The signal enters and travels to the left. You fine tune with your mouse. See text and print the "Help" file. It tells what you need to know. When you attempt a type-ahead for the first time, you will suddenly realize the program instantly goes to "transmit" mode. There is an instruction to overcome this problem. Also, when you click "mode" you will be surprised to discover that three other modes including PSK31 are included in the package. The upper buttons that have audio icons on them automatically bring up the soundcard driver adjustment windows. A lot of thought has gone into this program and, finally, it looks like it may be taking hold. Another new mode! And for free!!

When I did hear back from Les, he told me he had already discovered all these tweaks and still felt the other program was easier to tune. I can only go on the fact he liked everything else about the program. I don't know of any other software where the tuning panel has so many options.

You may be among those who find, from time to time, that the URLs in The Chart are incorrect. I appreciate any word on those changes. It takes a few months from the time I learn of them until I can get them changed in the magazine. But I do try to keep on top of it and supply what info I can as soon as I can.

I mention this because I have had several inquiries of late about inaccuracies in need of update (other than omissions in transit which I also provide answers for) about the Logger and K4CY scope programs. I found the listing had to be changed again on the Logger and Zakanaka, so that is new again as of this month.

Also, a wakeup call came in from an old friend, Bob W6EUZ, that he couldn't raise the Pasokon SSTV site we have displayed in the chart for so long. I checked every which way I could for some address change and kept coming at a dead end with the "can't be found"-type messages. The result was a contact to John Langner, the author of the very informative Web site and a short time later, all was well again. The info with the software is back for our viewing and using pleasure.

I have used the Pasokon Lite in my laptop, and it has worked very well for portable applications. A truly remarkable feat I have mentioned often. The software works in DOS mode and seems easier for the laptop to control than some of the Windows™ applications.

If you are looking for the audio spectrum scope, it appears the K4CY scope has disappeared; I have referred folks to the IZ8BLY download page because I know Nino wrote a scope program that is supposed to be a good one. I haven't tried that one. I am looking for a little space in time and some feedback from those who try it (also added to The Chart).

One other little tidbit. As I was discussing new modes with Paul in the QSO where the screenshot came from, the subject of Throb came up. He has been able to use it successfully. I haven't as yet. So, there I am, behind the times. Have to keep playing catch-up with all you guys.

Continued on page 56

Source for:	Web address (URL):
Mix W Soundcard program for PSK31, RTTY, new modes, MTTY, FSK31, more	http://tav.kiev.ua/~nick/my_ham_soft.htm http://users.nais.com/~jaffejim/mixwpage.htm
MMTTY New RTTY soundcard freeware plus links to other software	http://www.geocities.com/mmtty_rtty/
TrueTTY — Sound card RTTY w/ PSK31	www.dxsoft.com/mitrtty.htm
Pasokon SSTV programs & hardware	www.ultranet.com/~sstv/lite.html
PSK31 — Free — and much PSK info	http://aintel.bi.ehu.es/psk31.html
Interface for digital - rigs to computers	www.westmountainradio.com/RIGblaster.htm
Interface info for DIY digital hams	www.qsl.net/wm2u/interface.html
WinWarbler info and free download	www.qsl.net/winwarbler/
Site with links to PSK31 and Logger 7, also Zakanaka	www.geocities.com/kc4elo/
PSKGNR — Front end for PSK31	www.al-williams.com/wd5gnr/pskgnr.htm
Digipan — PSK31 — easy to use — new version 1.2	http://members.home.com/hteller/digipan/
TAPR — Lots of info	www.tapr.org
TNC to radio wiring help	http://freeweb.pdq.net/medcalf/ztx/
ChromaPIX and ChromaSound DSP software	www.siliconpixels.com
Timewave DSP & AEA (prev.) products	www.timewave.com
Auto tuner and other kits	www.ldgelectronics.com
XPWare — TNC software with sample DL	www.goodnet.com/~gjohnson/
RCKRtty Windows program with free DL	http://www.rckrtty.de/
HF serial modem plans & RTTY & Pactor	http://home.att.net/~k7szl/
SV2AGW free Win95 programs	www.raag.org/index1.htm
Source for BayPac BP-2M & APRS	www.tigertronics.com/
BayCom — German site	www.baycom.de/
BayCom 1.5 and Manual.zip in English	www.cs.wvu.edu/~acm/gopher/Software/baycom/
Int'l Visual Communication Assn. — nonprofit org. dedicated to SSTV	www.mindspring.com/~sstv/
Creative Services Software	www.cssincorp.com
Hellschreiber & MT63 & Stream & scope	www.freeweb.org/varie/ninopo/iz8bly/index.htm

Table 1. The Infamous Chart: Almost everything ... (updated monthly).

Then there also occurred some other thoughts and remembrances I haven't been keeping up with — other software. I checked the ChromaPIX program with the setup I had been using for the other soundcard programs discussed here lately and it wasn't working to expectations. So I checked into the Silicon Pixels Web site to see what updates were available.

There came a major update which I downloaded, along with a new 35-page manual that is well worth the effort to download and print. Just about everything you ever will need to know to make the program perform flawlessly.

After downloading a fresh copy of ChromaPIX, I followed the instructions and removed the older program and installed the new. The format has few changes, but I tuned to 14.230 where there was a lot of QRM and some relatively weak image signals and then, with no adjustment whatsoever, the images started to appear on the screen. I was duly impressed.

I don't know what the difference was from the old to the new, but the old program, for whatever reason, was not decoding the SSTV and the new is simply great. I have read most of the new manual and that is a definite improvement over the old CPIX manual. Very well defined, plenty of clear examples, and understandable. I am not a graphics pro, but this program may cause me to turn a corner in my interests.

If you have questions or comments about this column, please E-mail me [jheller@sierra.net]. I will gladly share what I know or find a resource for you. For now, 73, Jack KB7NO.

The Digital Port

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Actually, I think there is something wrong with my copy of Throb. I could never find a signal to decode and print, and then I determined that if I did, I wouldn't be able to contact them because the program seemed not to transmit. That will probably heal before this gets into print. I will download a fresh copy and reinstall. If it works for someone else, it should work here. Although that is not always true. I have a copy of a very popular piece of software that locks up when I go into the setup mode. But it receives and I believe I got it to transmit also. Computers are not all alike is one excuse. Hard to build a program that fits all sizes and shapes everywhere. Especially if you turn this ham loose on it.

I got so caught up in the new modes and the great soundcard programs in the last year or so that I realized I was ignoring one of the really fascinating aspects of ham radio. That is Slow Scan Television or SSTV as we commonly refer to it. *Continued*

QRX
continued from page 6

On Saturday we had several visitors drop by, which added to the excitement of the event. The Executive Director of the Biloxi Chamber, Harry B. Joachim, dropped by and chatted with us for a while. He presented us T-shirts with the new Biloxi Chamber logo on them. He also said that we would be able to use the building next year and in the years to come.

To promote the International Lighthouse/ Lightship Weekend, we have tossed around the idea of sending NTS (National Traffic System) messages from the lighthouse. Our lighthouse is sort of unique because it is on the historical register, and the city conducts tours of the structure. Lots of tourists visit it. Harry told us that he would have a banner made for us, and all we needed to do is tell him what we wanted on it. ... I have never heard of a city that helped hams out as much as Biloxi MS. I am certainly glad that I stumbled onto this event.

Sunday was a slow day for participation. I arrived at the site around 7 a.m. and started operating the station. I added 50 QSOs to the list before I had to leave to attend church. I returned to the site around 1733 UTC and started calling CQ again, and it seemed like everyone in the world was waiting for me to get there. First I checked the other bands, and the only one that was producing Qs was 20 meters. Around 1800 UTC, Randy N5UE showed up and relieved me for a couple of hours, and after that we took turns operating.

Randy and I were the only operators for Sunday, but Kim N5XGI, my old standby, came by to help take down the station.

With the close of the day and a weekend well spent, we were very proud to have accumulated 933 QSOs and 17 lighthouses, with one station running and 4 operators. We are all looking forward to a better International Lighthouse/Lightship Weekend next year. Maybe we will be able to put up two stations and work more bands! 73

SV8 from the Geranium
continued from page 13

seemed to be working! Just after the Sun had set, more pressure was exerted to get ready to go out for dinner and enjoy the evening. Activity during the week fell into our well-established pattern of a couple of hours in the mornings, usually between 0600 and 0900 UTC, and a couple of hours in the afternoons, usually between 1500 and 1700 UTC.

With improved conditions in the last year, I was able to make more use of the higher bands. 18.1, 21, and 24.9 MHz produced most QSOs, at the expense of 7, 10.1 and 14 MHz. **Table 1** shows a comparison of activity by band over in the five years up to and including 1999.

I've never previously bothered to go on the air on the morning on which we leave, but made an exception last year, having missed a whole day's operating at the beginning of the week. The last hour was very slow, and the last QSO was with W3NZ on 14 MHz CW at 0629 UTC on 23 June 1999.

Special QSLs were printed and are available either from my *Callbook* address with return postage or via the RSGB bureau.

My special thanks to my wife Jan and to Paris and Maya Panayoyopoulos of the Geranium Apartments, without whose tolerance and encouragement these operations would not have been possible. 73

ATV Exciter
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As capacitors for the microwave buffer transistor, we use pieces of wire (yellow insulation) to provide loose coupling in and out. This prevents parasitic oscillation at 1.8 GHz, and makes the prescaler output look cleaner on the oscilloscope. I chose to use the 9.6 V supply for this BFR91, not the 12 V supply as shown in the diagram. Grant confirms that both supplies work. I found surface mount resistors, in quantities of 50, for the attenuator ahead of the ERA4 pre- driver chip. It has less gain, but was easier to obtain than the ERA5.

Having established that this exciter tunes, without jumping, over the desired frequency range, I connected my 23cm receiver to the AV input of the TV, and stuck 6cm-long bits of wire to the exciter output and the receiver antenna socket. (The 6cm wire is a 1/4 wave antenna.) Then I connected my video camera to the video input of the board. I switched on everything, and tuned the receiver. The image would not lock. Bother. Hang on, what do the

switches do again on the receiver? Ah, the LEFT switch inverts the video polarity. Yippee! Now it works every time I try.

On several days, I spent up to an hour playing tapes from my camera through the 23cm setup, from the last Morris Tour and the last Auckland Folk Festival. **Photo D** was taken from the TV screen.

Thanks to Grant Taylor ZL1WTT and Wayne Griffin ZL1UJK for their documentation and assistance with this article. 73

Vaya Con (Ra)Dios

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and for 2 meters he has a Sommerkamp FT-290. He operates mostly on CW, some RTTY and SSB, and has over 210 entities for his DXCC. He has over 100 awards and he logs with KINGWIN, a Spanish program made by EA7ABW. Rodolfo has several types of QSL cards, one with a color photo showing the operator and his station.

The next one was in Catadau, 10 miles from Valencia: José EA5EE (**Photo Q**), a motorcycle mechanic licensed in 1979. His 38-foot-high tower is on the roof at 42 feet from the ground. José has a 3-element yagi for 10-15-20 meters, an inverted V for 40 and 80 meters, and a vertical for 2 meters. Just like many other Spanish hams. His rigs are: TS-850S, TS-140S, TS-50, three HTs, and four computers. He works SSB and SSTV, he is a contester and a DXer with over 150 entities. He logs with PLOG, a Spanish program made by EA5OL, and has two types of QSL cards.

When I entered José's radio shack, I did not know whether to grab a microphone or to kneel down and pray. It looks like a chapel, with lots of carved saints and pictures of saints on the back wall, behind his desk with his radio equipment. He even gave me a small picture of J.C., and I don't mean Juan Carlos. When I kneeled in front of him to take some photos from another angle, I had the distinct feeling that José blessed me. I hope the editors will choose to publish the photo of José EA5EE, so the readers will have the same religious encounter I experienced in his chapel-in-the-shack.

After this, we returned to Valencia and had a dinner in a little outdoor restaurant. Some children came by begging and handing out some leaflets saying that they are refugees from Romania. I spoke with one of them, as I had recognized the typical colorful clothing the gypsies were wearing; they were indeed Romanian gypsies doing what they do best — well, second best.

The next morning, I took the cheapest train I could get and returned to Barcelona. I had had lots of fun in Valencia because the visits were well organized and I could see lots of hams in a short period of time. Thanks to Eduard EA3NY who suggested this side trip, and to Pepe EA5KB and Enrique EA5AOR, who made it possible. 73

CALENDAR EVENTS

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is available for those who do not have Internet access, but who are interested in the contest. Send an SASE to: *Crystal Radio Building Contest, c/o Lawrence A. Pizzella WR6K, 856 Ironwood Drive, San Jose CA 95125-2814.*

DEC 18–JAN 2

CINNAMINSON, NJ Join the Amateur Radio Lighthouse Society in their "Lighthouse Christmas Lights" special event, to promote public awareness of ham radio and lighthouses; to contribute to the recognition that lighthouses, lightships, and their keepers deserve; to foster camaraderie within the ham fraternity; and to provide fellowship amongst the members of the Amateur Radio Lighthouse Society. This is not a contest and you do not have to operate from a lighthouse in order to participate. Time: 0001 UTC Dec. 18th–2359 UTC Jan. 2nd. Modes: Any and all! SSB, FM, PSK, SSTV, even light beams and semaphores. Repeater operation is also allowed. Bands: Any authorized bands including WARC. Suggested frequencies (±20 kHz): 1.970, 3.970, 7270, 14.270, 21.370, 28.370. Procedure: Call CQ Lighthouse or CQ/LH. Exchange: ARLS members give out call sign, ARLS membership number (see your newsletter mailing label for yours if you don't know it), your name, and state or province. Nonmembers give callsign, name and state or province. Awards: Certificate for working 10 or more lighthouses/ships or 5 or more member ARLS stations. Send log info to *ARLS, P.O. Box 2178, Cinnaminson NJ 08077 USA.* Include SASE 9- x 12-inch envelope and $1 for return of certificate. Send questions via E-mail to *Jim K2JXW at [weidner@waterw.com].*

FEB 16–FEB 25

ST. SIMON ISLAND, GA The Third Annual International "Elmer Memorial" Crystal Radio DX Contest will take place from 1200 UTC on Friday 16 February 2001 to 1200 UTC on Sunday 25 February, 2001. Rules for this contest can be found at [http://www.thebest.net/wuggy/]. These contests have been coordinated to allow those who build a Crystal Radio to enter in the Building Contest, to use their creation in the DX contest and report on its performance in the DX contest. For those without Internet access, a hard copy of the rules for the DX contest can be obtained by sending an SASE to: *Crystal Radio DX Contest, c/o O. Pool WB4LFH, 216 Hermitage Way, St. Simon Island GA 31522.* You can hear lots of DX on the Broadcast band with the right kind of Crystal Set, Antenna, Ground and Phones. During the first two contests 1000+ mile DX was routinely logged. These were not just the 50kW clear channel stations, but many 1kW and 5kW stations. Those who want to learn how to make a high performance Crystal Set, or are just curious about what is involved, are invited to visit *[http://clubs.yahoo.com/clubs/thecrystalsetradioclub]*, read the archived posts, look at the pictures of some crystal sets built by the members, and get to know this interesting group of "ultimate QRPers." 73

HOMING IN

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There's lots more to say and show about the 2000 ARDF World Championships. You'll be seeing it in "Homing In" and elsewhere in the ham radio press. My Web site has all the details of Team USA's individual and team performances, plus additional photos and links to reports by others. If this sport interests you, read all about it and find out what ARDF activities are taking place in your area. Maybe you'll be a competitor at the 2001 USA ARDF Championships, now being planned for the first August of the real new millennium.

Future Champs in the Scouts?

Here in Orange County, California, the annual Jamboree-On-The-Air (JOTA) on October 21 was bigger and better than ever. Over 870 Scouts descended on Rancho Alamitos High School in Garden Grove to participate in 13 ham radio exhibits, including HF, VHF, ARES, RACES, ATV, APRS/Packet, CW and hidden transmitter hunting. I put ten foxboxes on the school grounds, ranging from easy-to-spot ammunition cans in the bushes to a tiny micro-T taped on the pipes under a water fountain.

None of the Scouts had ever tried this activity before, so they all needed some quick training. Fortunately, I had some expert helpers, including Tom Curlee WB6UZZ (in **Photo E**), coauthor of our book on RDF. (*Transmitter Hunting—Radio Direction Finding Simplified,* by Moell and Curlee, is published by TAB/McGraw-Hill, ISBN number 007-1560068.) Also helping was 15-year-old Jay Thompson W6JAY (**Photo F**) and his father Richard WA6NOL. Both had just returned from the ARDF World Championships in China, where Jay had competed in the Junior Division.

Scouts usually arrived at our foxhunting booth in groups of two or three, sometimes more. We found that a good way to start explaining RDF to them was to point out how it's used to find Emergency Locator Transmitters of downed aircraft. The techniques are similar to those used by biologists tracking radio-tagged animals in nature TV shows that most Scouts have seen.

After seeing how the RDF gear works, one Scout from the group was selected to track a transmitter as the others followed. The youthful hunter got continuous help and encouragement, of course. When he found it, another Scout was selected to find another ammo-can fox nearby. The last hunter

Continued on page 61

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Stay Inside and Propagate

Midwinter brings the coldest temperatures and lowest maximum usable frequencies to the northern hemisphere. Propagation will range from good to very poor and will be much the same as last January. Operators glued by habit to the lower bands will be the most disappointed, while DXers probing 20 meters and higher should find useful openings to most areas of the world. Since propagation patterns are constantly shifting, it is best to explore all HF bands to find the most opportunities.

Good to seasonally average conditions should prevail until the 9th. After that, a succession of solar disturbances will make the HF bands a challenge, particularly 40 meters and above. The worst periods will begin on the 14th and 25th and last several days, while other poor stretches can be expected to begin on the 9th and 20th. The bright spots in the forecast are for the dates just prior to these events.

I expect that January will bring a false peak to the current sunspot cycle and will be followed by several months of slightly reduced activity. The final summit will most likely be reached in early summer. Although my conclusions are based on different criteria than those used by the professional scientific community, the consensus is the same.

Band-by-Band Summary

10-12 Meters

Opens to the east in the morning hours and slowly moves west with the sun, finally closing in Asia during the late afternoon. No openings are expected at night. Short skip can range from 1,000 to 2,500 miles.

15-17 Meters

Good daytime opportunities worldwide, especially into the southern hemisphere. Signals peak toward the east before noon, to the

January 2001						
SUN	MON	TUE	WED	THU	FRI	SAT
	1 F-G	2 G	3 F-G	4 F	5 F-P	6 F-G
7 G	8 G	9 F-P	10 P	11 F-P	12 F	13 F-G
14 P	15 VP	16 P	17 F-P	18 F	19 F-G	20 F-P
21 F	22 F-G	23 F-G	24 F-G	25 P	26 VP	27 F-P
28 F-P	29 F-P	30 F	31 F-G			

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
EASTERN UNITED STATES TO:												
Central America	15 (40)	20 (40)	20 (40)	(40)	(40)	(20-40)	(15) 20	10-20	10 (20)	10-17	10 (20)	(10) 20
South America	(15) 20	20 (40)	20 (40)	20 (40)	x	x	(15-20)	x	(10)	10 (15)	10 (20)	(10) 20
Western Europe	40	40	40	40	(40)	x	(10-20)	10 (20)	(10) 20	(15-20)	(20)	(20-40)
Southern Africa	(20-40)	(40)	x	x	x	x	x	(10-12)	10 (17)	(12) 17	(15-20)	20
Eastern Europe	(40)	(40)	x	x	(20)	x	(10-20)	(10) 20	(20)	x	x	x
Middle East	(40)	(40)	x	x	x	x	(10)	(10-15)	15 (20)	20	(20)	(20)
India/ Pakistan	x	x	x	x	x	x	x	(15-20)	x	x	x	(20)
Far East/ Japan	(15) 20	20	(20)	(20)	x	x	(20)	x	x	x	x	(10-20)
Southeast Asia	(15-20)	x	x	x	x	x	x	(10-20)	(10-15)	x	x	x
Australia	(10-17)	(15-20)	x	x	(20)	(30-40)	(20-40)	(10) 20	(10-20)	x	(20)	(10-15)
Alaska	15-17	20-30	x	x	x	20-30	20-30	15-17	15-17	x	x	15-17
Hawaii	(10) 15	(20)	20	(20)	20 (40)	40	(20-40)	(20)	(15-20)	x	(10)	10 (15)
Western USA	(10) 40	(15) 40	20-40	(20) 40	40	40	40	(20-40)	(10-20)	10-20	10-20	10-20
CENTRAL UNITED STATES TO:												
Central America	(15) 20	20 (40)	(20) 40	(20) 40	(20) 40	40	(40)	(10) 20	10-20	10-15	10 (20)	15-20
South America	(15) 20	20	20 (40)	20 (40)	(20)	x	x	x	(10)	10	10 (20)	(10) 20
Western Europe	(40)	40	40	(40)	x	x	(20)	(15) 20	(10) 15	(15) 20	(20)	x
Southern Africa	20	(20)	x	x	x	x	x	x	(10-15)	(10) 15	15 (20)	20
Eastern Europe	x	(40)	x	x	x	x	x	(10) 20	(10-20)	x	x	x
Middle East	x	(40)	(20)	(20)	x	x	x	(10-15)	(10-15)	(20)	20	(20)
India/ Pakistan	x	(15)	x	x	x	x	(20)	x	(15)	x	x	x
Far East/ Japan	x	x	(20)	20	(20-40)	(40)	(20)	20	(15-20)	x	15	(15)
Southeast Asia	x	x	x	x	(20)	(20)	20	(15-20)	(15)	x	(15)	x
Australia	(10) 15	15	(15-20)	20	20 (40)	20-40	20 (40)	(20)	x	x	x	(10-15)
Alaska	15-17	15-17	x	x	x	(40)	(40)	20	20	x	x	x
Hawaii	(10) 15	(15-20)	20	20	(40)	(20-40)	20 (40)	x	(15)	(15)	(15)	(10) 15
WESTERN UNITED STATES TO:												
Central America	(20-40)	40	40	40	(40)	x	(20)	(10) 20	10 (20)	10 (20)	(10) 20	(15) 20
South America	17 (40)	(20)	x	x	x	x	x	(15)	12 (20)	10-20	10-20	12 (40)
Western Europe	x	x	(40)	(20)	(20)	x	(20)	(10-20)	(10) 20	(20)	x	x
Southern Africa	(20)	x	x	x	x	x	x	x	(10)	(15)	15 (20)	(15) 20
Eastern Europe	x	x	x	x	x	x	x	x	x	x	x	x
Middle East	(20)	(40)	(20)	20	20	(20)	x	(15)	(10) 15	(10-15)	(20)	(20)
India/ Pakistan	(15-20)	x	x	x	x	x	x	(20)	x	x	x	x
Far East/ Japan	(10) 20	(15-20)	x	x	(40)	40	(40)	x	x	x	(10-20)	10-20
Southeast Asia	(15)	(20)	x	x	x	x	x	(20)	(15) 20	(20)	(10-15)	10-15
Australia	(10-15)	(15-20)	x	x	x	(20-40)	(20-40)	20	(15-20)	15	(10-15)	10
Alaska	10-15	x	x	20-30	20-30	20-30	20-40	x	20	15	x	15-17
Hawaii	(15) 20	(15) 20	20	(20)	(40)	40	(20-40)	(15) 20	15 (20)	(10-15)	10 (15)	(10) 15
Eastern USA	(10) 40	(15) 40	20-40	(20) 40	40	40	(20-40)	(10-20)	10-20	10-20	10-20	10-20

***Table 1.** Dual numbers indicate that the intervening bands should also be usable. When one number appears in parentheses, that end of the range will probably be open on Good (G) days only.*

south around midday, and westward in the afternoon. Short-skip beyond 1,000 miles is typical.

20 Meters

20 meters will not be quite as reliable as usual because of solar activity, but is still the most versatile HF band. Openings begin at dawn and last into the early evening hours. On better days the band will remain open even later, especially toward the south. Short-skip is typically between 500 and 2,500 miles.

30-40 Meters

Best from sunset until sunrise. On good days Europe and Africa can be open all evening, with Central and South America dominating the nighttime hours. The Pacific is strongest after midnight, while Asia peaks near sunrise. Atmospheric static should be fairly low this month but will still limit communications. Short-skip extends beyond 700 miles at night and is between 100 and 1,000 miles during the day.

80-160 Meters

Expect some nice surprises, especially when atmospheric noise isn't too strong. Short-skip on 80 meters is beyond 2,000 miles at night but limited to about 300 miles during the day. 160 meters will probably be useless during the day but can provide short-skip from 1,000 to 2,000 miles after dark. Domestic activity on 160 meters usually peaks in the evening hours.

Happy New Year! 73

Homing In

continued from page 59

of the group, who had received the benefit of watching all the others' mistakes, got to find a well-disguised micro-T for a surprise ending.

For demonstration hunts like this, it's best if the fox transmitters are on different frequencies and run continuously, or nearly so. Short transmissions are OK for experts, but are discouraging to complete beginners. Success for every Scout is the goal, so don't make it too hard.

One-piece ARDF receiver/antenna sets with earphones, continuous tuning, and tone-pitch S-meter are preferred by champions, but they aren't suitable for situations like this. A simple beam, offset attenuator, and a scanner or handie-talkie with S-meter works best, because the instructor and everyone in the group can hear the signal and see the meter. This also demonstrates how simple and inexpensive an on-foot RDF setup can be. Plans for the yagis and attenuators are readily available on the Web. "Tape measure" yagis are safest for children to carry.

Southern California wasn't the only place where JOTA-2000 included radio foxhunting. In Albuquerque, New Mexico, regular transmitter hunters Mike Pendley K5ATM, Mike Eaton K5MJE, and Brian Mileshosky N5ZGT introduced Scouts to this sport at the local Council office.

What about your town? Start planning now to make radiosports an important part of ham radio in the new millennium. For more ideas about ARDF for Scouts and JOTA, see "Homing In" for January 1997 and the "Homing In" Web site. 73

On the Go

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Mission-Specific Nets: Although not an organization, any disaster will have the support of one or more nets which may be coordinated by one or more of the above organizations. During the development of a hurricane, you'll find the Hurricane Watch Net keeping tabs on things and meeting on 14.325 MHz. After a storm, nets will be set up to control and manage the message traffic into the disaster area. This may coordinate messages from NTS and/or requests for information about health and welfare submitted to the Red Cross, Salvation Army, or other group.

Of course we can expect the list to grow even more in the future. The Family Radio Service (FRS) has become increasingly popular for families keeping track of one another on vacation, at amusement parks, etc. Naturally, if someone with an FRS radio finds himself in a difficult situation, it is only normal that he would call for assistance using FRS. We are now seeing cases whereby an FRS user hears someone calling for help and alerts the appropriate agency for assistance. It is only a matter of time before some type of method is established which incorporates FRS into an emergency system like using channel 9 on Citizens Band.

Given all these choices, there must be at least one that appeals to you as a way to make a difference and contribute back to the community. Give it some thought, and let me know if you find a home where you can help out when things get a little out of control. 73

73 Congrats To

- Richard C. Johnson W3BI, Nazareth PA — Scheduled to receive the Coast Guard's second highest civilian honor, the Meritorious Public Service Award, in recognition of 37 years' service as a MARS operator. *(Thnx Petty Officer Kim Wilder, USCG, Portsmouth VA)*
- Nebraska's Ak-Sar-Ben ARC — Winner of the ARRL/ham industry competition for promoting the ARS-themed movie *Frequency. (Thnx WAØWRI, via* Newsline*)*

NEVER SAY DIE

continued from page 42

hit, and then again with the industrial revolution, which changed populations from being largely farmers to production line workers, and moved millions of people to cities.

The recent high-tech explosion in computers, communications, and transportation, with the incredible ballooning of the Internet, is changing the world again.

Just as shopping malls and strips killed downtown shopping, Internet shopping is starting to change the whole product marketing and distribution system.

When personal computers started in 1975, it was only a year until we started seeing computer stores opening. Indeed, I started with five stores I opened in the greater Boston and the southern New Hampshire area. This grew to a national chain of 58 software centers. But I saw the handwriting on the wall, with the entry of mail order stores offering a wider variety of products and overnight delivery — so I sold the chain. Today, in place of thousands of computer stores, we have a half dozen mail order giants. No more distributors. A few retail stores. And this is still before anywhere near the full impact of the Internet has hit.

The Internet is going to put more and more of a squeeze on prices, pushing out smaller and less efficiently managed retailers, and making it almost impossible for small stores to survive. Even entertainment complex super malls such as the one in Edmonton will not be able to survive the loss of their retail stores.

With groceries, clothes, and just about everything else being sold via the Internet, the business world of 2020 is likely to be vastly different from today, just as our world today is totally different from that of 1900 — it's just that changes are happening faster and faster.

Education, too, will be sold and delivered via the Internet, with bricks and mortar schools only needed to provide the hardware needed for people to build skills, and a baby-sitting function. Of course, with virtual laboratories, even the need for electronic and chem labs can be covered via software.

This is the world of 2020 for which school administrators should plan, but probably won't.

Most of the courses people need to pursue the three major career paths will be available via the Internet. However, once the word starts getting out about the advantages of pursuing an entrepreneurial path, one aimed at eventually starting and running one's own business (and I don't mean a mom-and-pop store), the interest in job-oriented careers will inevitably diminish.

What benefits can the college of 2020 provide that students will feel is worth $100,000 (or more) and a four-year investment?

The jobs of the future will be in high-tech research and development, manufacturing (done mostly in some other lower-cost, better-educated country), marketing, sales, and service (installation and repairs). Products will mostly be sold via video demonstrations on the Internet and by price.

Print media looks as if it will eventually be replaced by webpapers and webzines, and books will be automatically printed on demand by two or three Internet megabook companies. Retail book stores could be blown away.

We're already seeing television recording systems which automatically record any program that fits your interest profile. The next step will be the alerting of potential customers when a new book is being published which their interest profile suggests they might want. And, with the sale of 100% of all printed books, or even a download of the text, book costs will be reduced, so authors will do better.

The babies being born today will be of college age by 2017. Why would they want to run up big debts in order to sit in a class, listening to a grad student teacher subbing for a professor, when they can get even better information via the Internet, taught by a star performer, complete with a million bucks worth of graphics and enough interactivity to answer just about any questions?

Sherry has almost a hundred how-to-dance videos she sells. Her star is Kathy Blake, who's taught thousands of students, so she knows where people are going to have problems and what their questions are going to be. She answers those questions in her videos. The result is that her video dance lessons are so much better than anything else out there that once people discover them, they buy one video after another and are devoted fans. Her dance instruction is far better than 99.9% of the studio instructors can provide.

In all of my high school years I had only one exciting teacher. Ditto college. With video teaching, good teachers will be in high demand. These will be the exciting performers.

The picture for the survival of universities 20 years from now looks grim. I know, if I were to be consulted by a college president today, I'd recommend, as a first measure, that the university's business school start polling the alumni every year, asking them which of the courses they took have benefited them in their careers. And I'd have them also ask which courses they wish they'd had an opportunity to take. That would give the university feedback to help it adapt to the real needs of its students.

For the longer run, I'd get busy and start teaching the things a small business person needs to know. And I'd have the students produce video teaching courses. These could not only give the students a wide variety of business experiences, but would pay off for both them and the school.

Video business courses would be of interest to both youngsters and business people. Courses such as advertising fundamentals, accounting, business law, printing, speed reading, purchasing, warehousing, shipping alternatives, packaging, and promotion would be very popular.

Well, there's the future as I see it. Colleges that pioneer the way to 2020 will be in the best situation to stay in business. The future is going to present unlimited opportunities for entrepreneurs, as smaller businesses gradually replace today's giants.

There won't be any need for a PC Connection when we can buy every computer component, accessory, program, and other supplies directly from the manufacturers via the Web. And the savings from knocking out the retailers will be mostly passed along to us customers.

How long will it be in the ham field before Kenwood or Yaesu will be selling directly to us through an Internet site? Service? Please plug your transceiver into your computer with the supplied cable so they can diagnose any problems you're having from their HQ in Tokyo and UPS you a replacement module.

Magazines 2020

What will magazines be like in 20 years? I've got my robe and pointy seer hat on, and my crystal ball all warmed up.

Actually, it doesn't take much of a prophet to see where things are heading, it's just a question of how long it's going to take to get there. Normally, I'd predict the thousands of magazine titles now decorating newsstands, book stores, supermarkets, and so on, would be delivered via the Web within ten years, but I'm usually overly optimistic about how fast new technologies will be accepted, so let's say we'll be there by 2020.

We're already seeing more than shadows of what's coming in the growing number of dot-com ads in magazines. Well, that makes sense, particularly for general interest magazines, where advertising costs are so high that it's prohibitively expensive to present much of a sales talk via magazine ads. With a Web site the lid is off. There, an advertiser

Continued on page 64

Wise Up!

Here are some of my books which can change your life (if you'll let 'em). If the idea of being healthy, wealthy and wise interests you, start reading. Yes, you can be all that, but only when you know the secrets which I've spent a lifetime uncovering.

......Wayne

The Bioelectrifier Handbook: This explains how to build or buy ($155) a little electrical gadget that can help clean the blood of any virus, microbe, parasite, fungus or yeast. The process was discovered by scientists at the Albert Einstein College of Medicine, quickly patented, and hushed up. It's curing AIDS, hepatitis C, and a bunch of other serious illnesses. The circuit can be built for under $20 from the instructions in the book. $10 (#01)

The Secret Guide to Wisdom: This is a review of around a hundred books that will help you change your life. No, I don't sell these books. They're on a wide range of subjects and will help to make you a very interesting person. Wait'll you see some of the gems you've missed reading. $5 (#02)

The Secret Guide to Wealth: Just as with health, you'll find that you have been brainwashed by "the system" into a pattern of life that will keep you from ever making much money and having the freedom to travel and do what you want. I explain how anyone can get a dream job with no college, no résumé, and even without any experience. I explain how you can get someone to happily pay you to learn what you need to know to start your own business. $5 (#03)

The Secret Guide to Health: Yes, there really is a secret to regaining your health and adding 30 to 60 years of healthy living to your life. The answer is simple, but it means making some difficult lifestyle changes. Will you be skiing the slopes of Aspen with me when you're 90 or doddering around a nursing home? Or pushing up daisies? No, I'm not selling any health products. $5 (#04)

My WWII Submarine Adventures: Yes, I spent from 1943-1945 on a submarine, right in the middle of the war with Japan. We almost got sunk several times, and twice I was in the right place at the right time to save the boat. What's it really like to be depth charged? And what's the daily life aboard a submarine like? How about the Amelia Earhart inside story?If you're near Mobile, please visit the Drum. $5 (#10)

Wayne's Caribbean Adventures: My super budget travel stories - where I visit the hams and scuba dive most of the islands of the Caribbean. You'll love the special Liat fare which let me visit 11 countries in 21 days, diving all but one of the islands, Guadeloupe, where the hams kept me too busy with parties. $5 (#12)

Cold Fusion Overview: This is both a brief history of cold fusion, which I predict will be one of the largest industries in the world in the 21st century, plus a simple explanation of how and why it works. This new field is going to generate a whole new bunch of billionaires, just as the personal computer industry did. $5 (#20)

Cold Fusion Journal: They laughed when I predicted the PC industry growth in 1975. PCs are now the third largest industry in the world. The cold fusion ground floor is still wide open, but then that might mean giving up watching ball games. Sample: $10 (#22).

Julian Schwinger: A Nobel laureate's talk about cold fusion—confirming its validity. $2 (#24)

Improving State Government: Here are 24 ways that state governments can cut expenses enormously, while providing far better service. I explain how any government bureau or department can be gotten to cut it's expenses by at least 50% in three years and do it cooperatively and enthusiastically. I explain how, by applying a new technology, the state can make it possible to provide all needed services without having to levy *any* taxes at all! Read the book, run for your legislature, and let's get busy making this country work like its founders wanted it to. Don't leave this for "someone else" to do. $5 (#30)

Mankind's Extinction Predictions: If any one of the experts who have written books predicting a soon-to-come catastrophe which will virtually wipe most of us out are right, we're in trouble. In this book I explain about the various disaster scenarios, like Nostradamus, who says the poles will soon shift (as they have several times in the past), wiping out 97% of mankind. Okay, so he's made a long string of past lucky guesses. The worst part of these predictions is the accuracy record of some of the experts. Will it be a pole shift, a new ice age, a massive solar flare, a comet or asteroid, a bioterrorist attack? I'm getting ready, how about you? $5 (#31)

Moondoggle: After reading René's book, *NASA Mooned America*, I read everything I could find on our Moon landings. I watched the videos, looked carefully at the photos, read the astronaut's biographies, and talked with some of my readers who worked for NASA. This book cites 25 good reasons I believe the whole Apollo program had to have been faked. $5 (#32)

Classical Music Guide: A list of 100 CDs which will provide you with an outstanding collection of the finest classical music ever written. This is what you need to help you reduce stress. Classical music also raises youngster's IQs, helps plants grow faster, and will make you healthier. Just wait'll you hear some of Gotschalk's fabulous music! $5 (#33)

The Radar Coverup: Is police radar dangerous? Ross Adey K6UI, a world authority, confirms the dangers of radio and magnetic fields. $3 (#34)

Three Gatto Talks: A prize-winning teacher explains what's wrong with American schools and why our kids are not being educated. Why are Swedish youngsters, who start school at 7 years of age, leaving our kids in the dust? Our kids are intentionally being dumbed down by our school system — the least effective and most expensive in the world. $5 (#35)

Aspartame: a.k.a. NutraSweet, the stuff in diet drinks, etc., can cause all kinds of serious health problems. Multiple sclerosis, for one. Read all about it, two pamphlets for a buck. (#38)

One Hour CW: Using this sneaky booklet even *you* can learn the Morse Code in one hour and pass that dumb 5wpm HF entry test. $5 (#40)

Code Tape (T5): This tape will teach you the letters, numbers and punctuation you need to know if you are going on to learn the code at 13 or 20 wpm. $5 (#41)

Code Tape (T13): Once you know the code for the letters (#41) you can go immediately to copying 13 wpm (using my system). This should only take a couple of days. $5 (#42)

Code Tape (T20): Or, you can start right out at 20 wpm and master it in a weekend. $5 (#43)

Wayne Un-Dayton Talk: This is a 90-minute tape of the talk I'd have given at the Dayton, if invited. $5 (#50)

Wayne Tampa Talk: This is the talk I gave at the Tampa Global Sciences conference—where I cover amateur radio, cold fusion, health, books you should read, and so on. $5 (#51)

$1 Million Sales Video: The secret of how you can generate an extra million dollars in sales just by using PR. This will be one of the best invesuments you or your business will ever make. $40 (#52)

Reprints of My Editorials from *73*. Very few things in this world are as we've been taught, and as they appear. I blow the whistle on the scams around us, such as the health care, our school system,. our money, the drug war, a college education, sugar, the food giants, our unhealthy food, fluorides, EMFs, NutraSweet, etc.

1996 Editorials: 120 pages, 100 choice editorials. $10 (#72)

1997 Editorials: 148 fun-packed pages. 216 editorials. $10 (#74)

1998 Editorials: 168 pages that'll give you lots of controversial things to talk about on the air. $10 (#75)

1999 Editorials: 132 pages of ideas, book reviews, health, education, and anything else I think you ought to know about. $10 (#76)

2000 Editorials: In the works.

Silver Wire: With two 3-in. pieces of heavy pure silver wire + three 9V batteries you can make a thousand dollars' worth of silver colloid. What do you do with it? It does what the antibiotics do, but germs can't adapt to it. Use it to get rid of germs on food, for skin fungus, warts, and even to drink, Read some books on the uses of silver colloid, it's like magic. $15 (#80)

Wayne's Bell Saver Kit. The cable and instructions enabling you to inexpensively tape Art Bell W6OBB's nightly 5-hr radio talk show. $5 (#83)

NH Reform Party Keynote Speech. It wow'd 'em when I laid out plans for NH in 2020, with much better, yet lower-cost schools, zero state taxes, far better health care, a more responsive state government, etc. $1 (#85)

Stuff I didn't write, but you need:

NASA Mooned America: René makes an air-tight case that NASA faked the Moon landings. This book will convince even you. $25 (#90)

Last Skeptic of Science: This is René's book where he debunks a bunch of accepted scientific beliefs – such as the ice ages, the Earth being a magnet, the Moon causing the tides, and etc. $25 (#91)

Dark Moon: 568 pages of carefully researched proof that the Apollo Moon landings were a hoax—a capping blow for René's skeptics. $35 (#92)

Radio Bookshop

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Name ______________________ **Call** __________

Address ______________________________

City-State-Zip ______________________________

Use the numbers in the brackets or copy page and mark the books you want. Add $3 s/h per total order in US ($5 priority mail). $6Can. $10 foreign. ____________

Order total: US$ __________ Phone (for CC orders) ______________

MC/Visa for orders over $10. # ______________________ Expire ______

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☐ Yes! Put me down for a year of *73* for only $25 (a steal). Canada US$32. Foreign US$44 by sea.

☐ I'd like to get more romance into my dreary life so send me your How-To-Dance Videos catalog.

☐ I need some industrial strength stress reduction so send me your Adventures In Music CD catalog

Allow 4 weeks for delivery except foreign, though we try to get most orders shipped in a day or two.

Barter 'n' Buy

Turn your old ham and computer gear into cash now. Sure, you can wait for a hamfest to try and dump it, but you know you'll get a far more realistic price if you have it out where 100,000 active ham potential buyers can see it, rather than the few hundred local hams who come by a flea market table. Check your attic, garage, cellar and closet shelves and get cash for your ham and computer gear before it's too old to sell. You know you're not going to use it again, so why leave it for your widow to throw out? That stuff isn't getting any younger!

The *73* Flea Market, Barter 'n' Buy, costs you peanuts (almost)—comes to 35 cents a word for individual (noncommercial!) ads and $1.00 a word for commercial ads. Don't plan on telling a long story. Use abbreviations, cram it in. But be honest. There are plenty of hams who love to fix things, so if it doesn't work, say so.

Make your list, count the words, including your call, address and phone number. Include a check or your credit card number and expiration. If you're placing a commercial ad, include an additional phone number, separate from your ad.

This is a monthly magazine, not a daily newspaper, so figure a couple months before the action starts; then be prepared. If you get too many calls, you priced it low. If you don't get many calls, too high.

So get busy. Blow the dust off, check everything out, make sure it still works right and maybe you can help make a ham newcomer or retired old timer happy with that rig you're not using now. Or you might get busy on your computer and put together a list of small gear/parts to send to those interested?

Send your ads and payment to: *73 Magazine*, Barter 'n' Buy, 70 Hancock Rd., Peterborough NH 03458 and get set for the phone calls. The deadline for the March 2001 classified ad section is January 10, 2001.

President Clinton probably doesn't have a copy of *Tormet's Electronics Bench Reference* but you should. Check it out at **[www.ohio.net/~rtormet/index.htm]**—over 100 pages of circuits, tables, RF design information, sources, etc. BNB530

TELEGRAPH COLLECTOR'S PRICE GUIDE: 250 pictures/prices. $12 postpaid. **ARTIFAX BOOKS,** Box 88, Maynard MA 01754. Telegraph Museum: [http://wltp.com]. BNB113

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Never say die

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can present a total sales pitch, complete with an ordering option.

Web ads can include beautiful pictures, technical descriptions, videos, the works, with as much or little detail as customers want. Thus, all a magazine ad has to do is get potential customers to visit the Web site. Well, with Web publications, we'll probably see about the same thing happening, with the webzine getting a piece of the action when a reader clicks over to an advertiser's site, plus a commission if a sale is made.

We'll be seeing advertisers making a much bigger effort than they do today to have their product included in articles the magazine publishes. I'd love to have ham companies rustle up articles for 73 which would help to sell their products, but most of 'em just can't be bothered.

The subscription cost of webzines will be much lower than at present since there won't be the printing, paper, and mailing costs for the magazines. And this will kill newsstand sales, which are often losses for publishers, with the difference having to be made up by the advertisers.


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QRX . . .

Trouble in Space

Like you, we thought it was now "safe to go near the water" with some good news about last fall's Ariane launch of Phase 3-D, and so our Andy MacAllister W5ACM presented a rosy picture of things in his characteristically detailed "Hamsats" column this month.

Just prior to press time, though, and well after Andy's column was on its way to press, things started to go haywire. Roy Neal K6DUE picks up the story:

Ham radio's newest satellite is in trouble. Malfunctions in AMSAT Oscar-40's propulsion system have put the satellite into an unplanned orbit. Controllers are working on what they hope will be a recovery plan.

The AMSAT News Service said that the initial attempt to fire the satellite's rocket engine failed, apparently because helium valves did not open on command. Helium pressure is required to open the engine's fuel valves.

Controllers were trying to raise the orbit. After sending up a series of commands, ground controllers were able to get the helium flowing, but not at required levels. In a joint release, AMSAT Germany President Karl Meinzer DJ4ZC, and AMSAT-North America President Robin Haighton VE3FRH, said that enough pressure finally was built up and the spacecraft was programmed to perform an initial engine burn on Monday, December 11th.

The burn began as scheduled, but for unknown reasons continued three minutes too long. They say this put AO-40 into an unplanned orbit with a 60,000-

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NEVER SAY DIE

Wayne Green W2NSD/1
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CAFR

How much do you know about your state's Comprehensive Annual Financial Report? According to Walter Burien, who has done extensive research into the situation, this is the financial report that you haven't been seeing, as compared with the usual Annual Service Budget. I realize that you are not going to believe that the states and the federal government have been keeping two sets of books, a cute little maneuver which has been hiding around $45 trillion in assets. That's with a T.

About $32 trillion of that is invested in the stock market—and that's 53% of the stock in *all* publicly traded companies!

Well, I knew that the states had some good scams going for them, but I didn't realize their extent. For instance, up here in New Hampshire the state runs a chain of state liquor stores, plus tolls on the turnpikes. But some of the revenue sources are truly ingenious. Did you know that most of the states put through legislation forcing insurance companies to set aside 33% of their revenues in an escrow fund for the payment of claims? Okay, maybe you knew that. But I'll bet you aren't aware that instead of using the funds from the insurance premiums for the escrow the insurance companies borrow the money from their state at lower than the prime rate and use that money for the escrow fund. They then can invest their premium reserves in the stock market, where they can make a much higher profit on the investment. That accounts for another $8 trillion.

Plus, in a similar deal, $5 trillion in Bond Surety Escrow Accounts.

Meanwhile Congress has driven our taxes up over 50% of our paychecks. It comes to over 70% if you count the taxes on everything we buy, too.

If they'd cut out the double bookkeeping some states could operate tax-free, the national debt could be wiped out, and so on.

Well, we've been suckered into so many other things that this doesn't come as any big surprise.

My next step will be to see if I can find any yearly accounting reports for New Hampshire listing *all* the state's revenue sources. Like property taxes; gasoline; car, boat and skimobile registration; driver's licenses; hunting and fishing licenses; rooms and meals tax; Cannon Mountain tramway and ski revenues; The Flume revenues; Mt. Washington Carriage Road revenues; business profits tax; business inventory tax; turnpike tolls; liquor store profits; and who knows what else. Oops, I almost forgot the state lottery, which is a nice little moneymaker.

Say, when are you going to run for your state legislature and either get your share of the money your state is fleecing people out of or else maybe start making the scam public? Or you could just pocket lobbyist bribes for your retirement.

Reaching That 78%

With only about 22% of our licensees interested enough in the hobby to bother reading any ham rag, that leaves 78% who are unreachable, either to get them excited about expanding their ham horizons or in helping them find out about new gear coming on the market. Considering that subscriptions to the ham rags cost less than most people pay for a lunch for two, this indicates a serious lack of interest in the hobby by the majority of licensees.

There was a time when about 75% of us were reading a ham rag—so what's changed?

Well, one thing is the no-code Tech license, which marooned around 70% of us up on 2m, where someone 50 miles away is DX. So who needs a magazine full of contest and ARRL official club news, packet, RTTY, DXpeditions, ham satellites, and so on? Why would hams who don't even own a soldering iron want to read about construction projects? Even the simple ones? Most of these people memorized the ARRL *Q&A Manual*, got their ticket, and bought their HTs. End of story.

There's a simple way we can upset the hell out of our blindfolded brethren. And that's by making more and more of our repeaters cross-banded to the DX bands so they'll be able to get a taste of making DX contacts without having to get on the Internet to do it. Let's make some windows so they can see that there's a whole world out there. A beautiful, exciting world.

Listening to guys talk about very little or less of much interest on 160m and 75m wasn't what got me to learn the damned code so I could get my ticket—it was listening to the DX rolling in on 20m that did it. Wow! Australia! India! Kenya! Not in my wildest dreams did it occur to me that someday hams I'd worked in India would be taking me to see the Taj Mahal and teaching me to chew betel nut (ugh!). Or that a ham in Kenya would talk me into organizing an all-ham hunting safari in northern Kenya and personally show me the famous Ambouseli game park. Or that a New Caledonia ham would take me up in his plane for an air tour of his country.

It isn't difficult to crossband a repeater. I set up a repeater at my home station back in 1970 just so I could make 20m contacts with my 2m HT while I was getting my morning walking exercise, and I worked lots of DX that way. And my repeater up on the top of nearby Pack Monadnock Mountain (WR1AAB) was cross-banded to either 6m or 10m at the user's option, allowing any of the users to talk all around the world.

Please stop futzing around, and cross-band your repeater. Then let me know about what happens so we can get more repeater owners to add this function. I'll bet I might even start seeing some articles coming in on ways to make the DXing more flexible. You know, with remotely rotatable beams, remotely tuning the bands, and so on.

Also, let me know what happens as far as your users are concerned.

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kilometer apogee. Apogee is the satellite's most distant point from Earth.

Meinzer and Haighton said very detailed information on the engine burn was collected and had already given some indications as to what went wrong. They said final analysis could show that the situation might have no impact on the mission goals or that controllers may need to change strategy for achieving a useful final orbit.

But then the other shoe dropped. A report posted on the *CQ Magazine* Web site said that AO-40 may have stopped transmitting. The *CQ* story said that the last report of telemetry being received was at 11:16 UTC on Wednesday, December 13th.

On December 14th, AMSAT released another statement that confirmed the *CQ* report and went a lot further. It said that telemetry transmissions from AO-40 stopped while work on the propulsion system was in progress. Also, that an investigation by the AO-40 development team has begun.

Now, AMSAT says it is waiting for certain onboard software events to occur on Saturday afternoon, December 16th. These are programmed to start a spacecraft emergency routine called "command-assist" which attempts to re-establish communications. AMSAT says that this offers the best chance of recovering evidence of what made the telemetry transmissions stop.

Thanks to Roy Neal K6DUE, via Newsline, *Bill Pasternak WA6ITF, editor.*

Incentive Licensing: QCWA Says QRT

It's time to turn back the hands of time and end the inequity of Incentive Licensing. So says the Quarter Century Wireless Association, as it has filed a petition before the FCC asking the agency to restore privileges withdrawn from Advanced, General Class, and Conditional operators back on November 22, 1968, the day that an ARRL-fostered idea called Incentive Licensing came to ham radio and forever changed it.

The basic idea of Incentive licensing was to try to force higher technical standards in ham radio by compelling all of those then licensed to upgrade. To accomplish this, Advanced, General, and Conditional class licenses lost significant operating privileges. Novice class operators lost the right to use radiotelephone on 2 meters.

To regain the privileges withdrawn, a ham had to upgrade to Amateur Extra Class by passing a 20-words-per-minute Morse test and an engineering-level written examination. Those in the ARRL who had pushed the idea of Incentive Licensing honestly believed that forced upgrading would lead to more technical innovation by hams. Instead, tens of thousands of operators sold off their stations for pennies on the dollar and completely disappeared from ham radio. Others protested by refusing to upgrade. This led to animosity between hams of different license classes, as well as between some hams and the American Radio Relay League."

But the loss was not limited to those no longer on the air. There was a trickle-down effect that in turn hastened the demise of long-established amateur equipment manufacturers like Hammarlund, National, and Hallicrafters. Others, like E.F. Johnson, abandoned the amateur marketplace and looked to other radio services to survive. And after all these years, some people have not been able to let go of their grudge.

According to Gary Harrison KØBC, QCWA president, the way the QCWA envisions bringing everyone back together is by restoring as many of the operating privileges lost by Advanced, General, and Conditional class hams as is possible under today's Part 97 rules.

It is the QCWA view that no useful purpose is being served by continuing to deny the privileges withdrawn from those amateur operators who still suffer from Incentive Licensing. It says that there are still several thousand amateur operators who were negatively affected by Incentive Licensing. QCWA says that the only way to end the inequity is by restoring the privileges lost on November 22, 1968. As we go to print, no rulemaking number has been assigned to this request.

Thanks to QCWA, via Newsline, *Bill Pasternak WA6ITF, editor.*

TAPR Taps Ackermann

At the 19th Annual TAPR/ARRL Digital Communications Conference in September, TAPR (Tucson Amateur Packet Radio) elected John Ackermann N8UR as its new president.

One hundred thirty-five hams, including a dozen from outside the US, attended the annual event, which includes presentation of technical papers, hands-on demonstrations, and beginner's sessions. Over 100 people attended Friday afternoon's APRS seminar, and 70 were present for a technical symposium on programming PIC chips held Sunday morning.

Ackermann succeeds Greg Jones WD5IVD, who had served as president since 1993, with Steve Bible N7HPR, replacing Ackermann as vice president. Bob Hanson N2GDE, will continue to serve as secretary, and Jim Neely WA5LHS remains treasurer. The elections were held at TAPR's annual board meeting, held in conjunction with the DCC.

"Greg Jones led TAPR through a period of growth and innovation," Ackermann said. "On his watch, we brought significant new products to market, including the DSP-93 digital signal processing unit, Totally Accurate Clock, and MIC-E and PIC-E data encoders. Greg also laid the groundwork for our Frequency Hopping Spread Spectrum Radio project. He guided us into the Internet age, along the way creating the TAPR SIG mailing lists that now handle thousands of messages per month. Greg is also responsible for our increased publishing activities. His retirement leaves a void in TAPR that will be hard to fill."

Ackermann said that his primary objective will be to ensure that TAPR remains on the cutting edge of radio technology, with a special emphasis on emerging concepts such as Software-Defined Radios. He will also focus on increasing membership and optimizing the organization's management structure.

Ackermann (ex-AG9V), who lives in Dayton, OH, has served on the TAPR board of directors and as vice president since 1995. He was first licensed in 1974 and has helped build packet radio networks in Ohio and Wisconsin. Ackermann is active on APRS, runs a Linux-based Internet site at his home, and can occasionally be found on CW chasing DX.

Bible lives in Kingsland, GA, and has been a TAPR board member since 1996. He was project manager for TAPR's Totally Accurate Clock (TAC-2), EVM Radio Interface, PIC Encoder, and DGPS Reference Station kits. Bible is leading TAPR's development of a road map to develop Software-Defined Radio technology for amateur use.

In other news from the DCC:

• TAPR announced that it will be offering the "EasyTrak" satellite rotor and radio controller. This PIC-based unit will control azimuth and elevation rotors for satellite use, as well as tune popular radios for Doppler correction.

• PRUG, the Packet Radio Users Group of Japan, demonstrated the possibilities of low-cost Internet-connected sensors and software mobile agent technology. PRUG also introduced the TINI-AMEDES, a Java-based one-board computer with Ethernet interface that supports the Dallas Semiconductor 1-wire interface. They also provided an update on their 2.4 GHz spread spectrum radio, which has been commercialized by Root, Inc.

TAPR is a nonprofit research and development corporation dedicated to advancing amateur radio through digital technology. It focuses on development of hardware and software tools that enable ham radio operators to explore leading-edge technologies. Despite its name, TAPR is an international organization with over 2,000 members worldwide.

For more information, telephone (940) 383-0000, or E-mail [tapr@tapr.org]. Their Web site is at [www.tapr.org].

Thanks to TAPR for this.

Oops!

Our apologies to Ernest "Ernie" Orman, Jr. W5OXA/W5B/KP2 for misspelling his name in last month's interesting QRX item on the Old Biloxi Lighthouse.

LETTERS

From the Ham Shack

John Baxter N3FPZ [jbaxter@voicenet.com]. I am really enjoying getting to know you, Wayne. We're kindred spirits, but I have not been so incredibly successful at realizing my dreams. I am working on this, and now you're helping me with your thoughts ... thanks!

Story of my life in three sentences: I'm N3FPZ, licensed for about 13 years, and my work is as a test engineer with Motorola. I love music — the Love of My Life is a piano teacher and composer, and we are just getting going in her studio with digital recording. I love invention and ideas, so, needless to say, your materials are wonderfully useful and fascinating to me.

For now, I just wanted to pass along a suggestion — and please forgive me if somebody has already thought of this. I listened with a lot of interest to your talk from 1995 about the possibility of revitalizing ham radio by encouraging young people, with the side benefit of revitalizing America's ability to innovate technically. This would be, as the kids might say, "awesome."

Might we create a "chain reaction" effect if we started a movement to get individual hams to spend a very small amount to provide their local school libraries, and selected kids, with:

1) Subscription to *73* magazine.
2) Copy of *ARRL Handbook* (if ready).
3) Simple receiver to monitor 2 meter repeater traffic.
4) Simple receiver to monitor world band broadcasts.
5) Very simple BFO circuit to allow world band receiver to copy SSB and CW.
6) Package of information about ham resources available on the Web.
7) Other cool stuff that kids would love.

Total cost of selected items is a few bucks to a couple hundred. Multiplied by the number of hams willing to do this ...

What brought this to mind was remembering key people who gave me an *ARRL Handbook* early along, and friends who otherwise encouraged me.

Thanks for all you do, Wayne! By the way, I just met Charles Martin here at Motorola Broadband Communications Sector in Horsham PA. He used to work for you ... small world! Charles is AB4Y.

Good thought! The first thing I did when I got interested in amateur radio was head for the school library, where I found copies of QST. *— Wayne. [And please say hello to Charles, "The Pride of Bowling Green," for us all. He has been a friend of* 73 *for almost 25 years, contributing reports and ideas from the world over, stateside to Mozambique. — J.B.]*

Scott Dennis AL7EM. I have long remembered your mention about researchers who were compressing speech digitally by using phonemes. I just ran across an article about how JPL researchers are doing something similar, and wanted to pass it along. I would love to see this developed for ham radio! Here are the links:

• [http://www.jpl.nasa.gov/releases/2000/digitalperson.html]
• [http://www-b.jpl.nasa.gov/releases/2000/digitalperson.html]
• [http://www-b.jpl.nasa.gov/pictures/tech/digitalpersonnel/].

OK, guys, let's get busy with this. — Wayne.

Gary KG4JPP. I just wanted to let you know I just got my Technician license as a result of a show you did with Art Bell on ham radio about a year ago.

Congratulations! — Wayne.

Bill Haddad WD9HXH. During WWII, I participated in action against the enemy at the battles of Tarawa, Saipan, Tinian, and Okinawa. Through the years, I have read many accounts and details of these and other battles. In my opinion, few of these writings really portray what it is like to be involved in the chaos of war. I am more than somewhat convinced that two people witnessing an event cannot agree as to what took place. Most writers of history weren't involved in the action, and the ones who were can only portray a small part of that history. This does not apply to one of the most interesting accounts of WWII I have read about. You guessed it! Your life as a submariner in WWII. After reading your book, I laid it down. About a month later, I read it again. Wayne, I don't have to tell you what you already know. To wit, "This is one account people are crazy if they don't read!" I thoroughly enjoyed reading it the second time, and before the year is over, I intend to read it again.

Thanks, Bill. I wrote the book mainly for my old crewmates to read, so you know it has to be accurate. That's the way it really was ... and it sure was hairy at times! — Wayne.

Albert "Sonny" Solis KD5GBI. Wayne, I have been a ham radio operator for about 2 years now. I am 49 years old but have been interested in ham radio since I was 13. I got my license and bought an old TS-430 and I was on the air! My first contact was on 10 meters SSB to a station in California. I now work 15 meters or 40 meters CW. I have not updated to General and I wonder if it is worth it. With the new CW requirements, many hams thought it would be the end of ham radio. In my opinion, it died a long time ago. Let me share my very limited experiences with you. I wanted my daughter Amanda to get interested. We listened to 75 meters (3.950) and we heard the worst disgusting language! My daughter said that ham radio was just a collection of old, foul-mouthed men and she didn't want any part of it! You know, she's right. When I was young, the idea of talking to someone in another part of the world was exciting. The reality of what I hear is 10 to 20 second QSOs to DX stations. Well, so much for using ham radio to foster international understanding. Contests make 10 meters a joke. I then went to CW on 15 and 40 meters. Here I could "talk" to other hams. Wayne, I don't know what the answer is, but ham radio is dying. Getting youngsters involved is a step in the right direction but the old, foul-mouthed hams on 75 meters will certainly kill the hobby. I subscribe to your magazine, *CQ*, and *QST*. I subscribe to all in an effort to support the magazines. I don't QSO too often because of my work. I guess that I am just rambling now. Thought I would pass along my experiences. Thanks for reading this.

Being solution-oriented, here's a suggestion on how we can clean up the garbage-mouthed old farts. The next time you hear some old-timer trashing us, tape him. Step two is to use a telephone ROM and get the names and addresses of his neighbors. Step three would be to anonymously send them a note and a copy of the tape, asking them to ask their neighbor to clean up his act. — Wayne.

Dr. David Babulski N4XVF
2677 Colony Circle
Snellville GA 30078

Way Cool Rocket Project, Part 1

This 70cm rocketborne radio telemetry system is strictly for kids — NOT!

This is the first in a series of three articles that will describe the construction and flight operation of a basic single-channel 70cm (433 MHz) rocketborne radio telemetry system, or rocketsonde.

The transmitter portion of this system is mounted in a small sounding rocket and used to telemeter air temperature of an atmospheric air column to 2,000 meters (about 6,000 feet). The ground-mounted receiver portion of the system is used with a fully steerable antenna array consisting of two stacked Ramsey Electronics four-element 433 MHz yagi antennas. Receiver output is supplied to a strip chart recorder.

This telemetry system is currently being utilized as an instructional tool in a volunteer-led, after hours, high school science enrichment program called "Sounding Rocket 101." The primary purpose of the program is to provide a hands-on science activity to high school science clubs that will provide additional learning opportunities in the areas of: electronics, communications, atmospheric science, and applied physics. The Sounding Rocket 101 program is presented in a way that ignites student interest (no pun intended!).

One of the primary design goals for the telemetry electronics was to produce an easy-to-build, low-cost, single-channel radio telemetry system that could be easily duplicated by an electronically inclined high school student. The purpose of this series of articles is to encourage other radio amateurs to duplicate the system and become involved with providing additional advanced learning opportunities for high school students.

In keeping with the low-cost design objective, the core elements in the radio telemetry system are 433 MHz AM transmitter and receiver modules

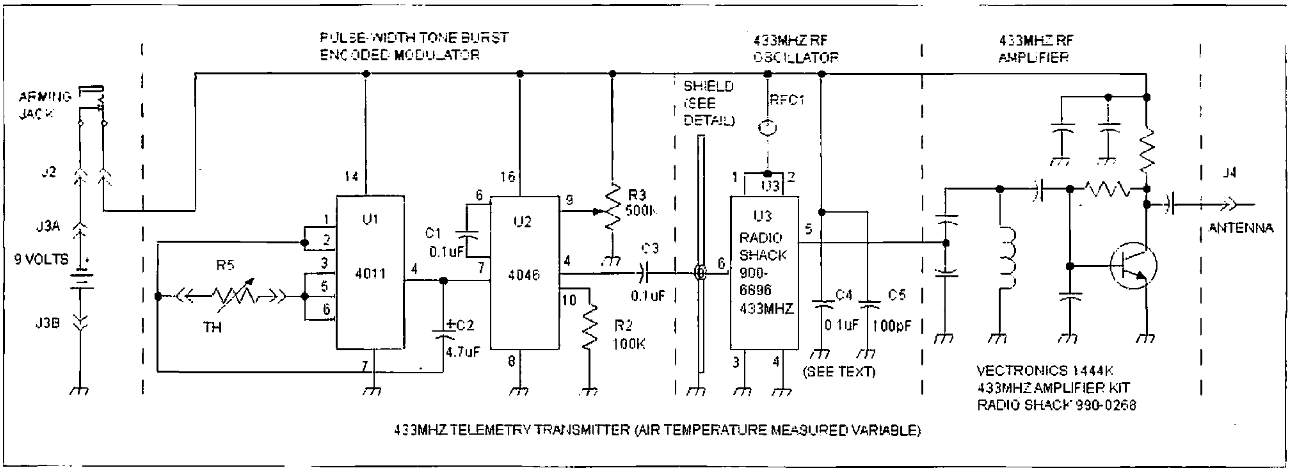


***Fig. 1.** Transmitter schematic (see also Fig. 8).*

available from Radio Shack. Although the Radio Shack UHF modules are designed for short-range (several hundred feet) remote control use, through the use of external circuitry their effective communication range can be extended to a little over a mile. The total cost for both modules is less than twenty dollars. To further minimize cost, off-the-shelf circuit assemblies are used were possible. Total cost for all three of the electronic modules used in this project is less than fifty dollars.

The transmitter

Figure 1 — Transmitter schematic. A Radio Shack 8 milliwatt RF output, SAW-device-controlled, 433 MHz AM transmitter module (Radio Shack #900-6896) is used as the core element for the telemetry transmitter. A 4011 quad 2-input NAND gate is used as a variable pulsewidth oscillator. The resistance of the thermistor, R1, determines the width of the output pulse. Output from the 4011 is supplied to the input of a 4046 phase locked loop integrated circuit. Here, the pulse provided by the 4011 is converted to a tone pulse. Potentiometer R3 is adjusted for a tone frequency of about 2 kHz. This 2 kHz tone pulse is capacitively coupled to pin 6 of the transmitter module ("Code in" or modulation input).

RF output from the transmitter is taken from pin 5 of the transmitter module and supplied to the input of a Vectronics 1444K 433 MHz RF amplifier. Although this amplifier is primarily designed as a preamplifier for receivers, in low power applications it also works very well as an RF power amplifier.

Using the RF amplifier, output from the transmitter module is increased from 8 milliwatts to about 80 milliwatts. Using an impedance matching network at the output of the amplifier was experimentally determined to be unnecessary at the power levels being considered in this application. This RF output level is sufficient to ensure reliable data collection from the design altitude of 2,000 meters. Power for the transmitter is provided by a standard Duracell 6LR61 alkaline 9-volt battery. A closed circuit two conductor jack, J1, is used as an on/off switch when the transmitter package is installed in the rocket airframe. A blank plug is inserted in the jack to remove power from the transmitter.

The receiver

Figure 2 — Receiver schematic. A Radio Shack 433 MHz AM receiver module (Radio Shack #900-6895) is used as the core element for the telemetry receiver. Radio Shack does not provide a schematic of the receiver. However, from an examination of the component layout on the miniature circuit board, the receiver appears to be of the super-regen type. A 7805 five-volt regulator is used to provide power to the receiver. The same Vectronics kit used as an RF power amplifier for the transmitter is also used with the receiver as an RF amplifier at the front end of the receiver. A Rainbow Kits AA1 audio amplifier kit (Radio Shack #900-6895) is used on the back end of the receiver. A two-conductor open circuit phone jack is placed in parallel with the speaker to supply audio to a small tape recorder.

The telemetry decoder

Figure 3 — Decoder schematic. An LM555 timer IC is connected as a frequency-to-voltage converter. The values of resistance and capacitance used with the IC are selected for a pulse tone frequency of about 2 kHz. Voltage output from the decoder varies from 0 volts with no pulse input to about +5 volts with a 2 kHz tone input. A 5 megohm potentiometer is used to attenuate output of the decoder for use with a strip chart recorder.

An SPDT switch (SW2) is used to bypass the 5 meg pot for output to a computer or other recording device. Before the telemetry system is used to gather data in flight, the entire rocketsonde transmitter payload package is enclosed in a sealed chamber and exposed to a range of temperatures. Output from the received and decoded signals are recorded and used as calibration data. The participating students use the calibration data to

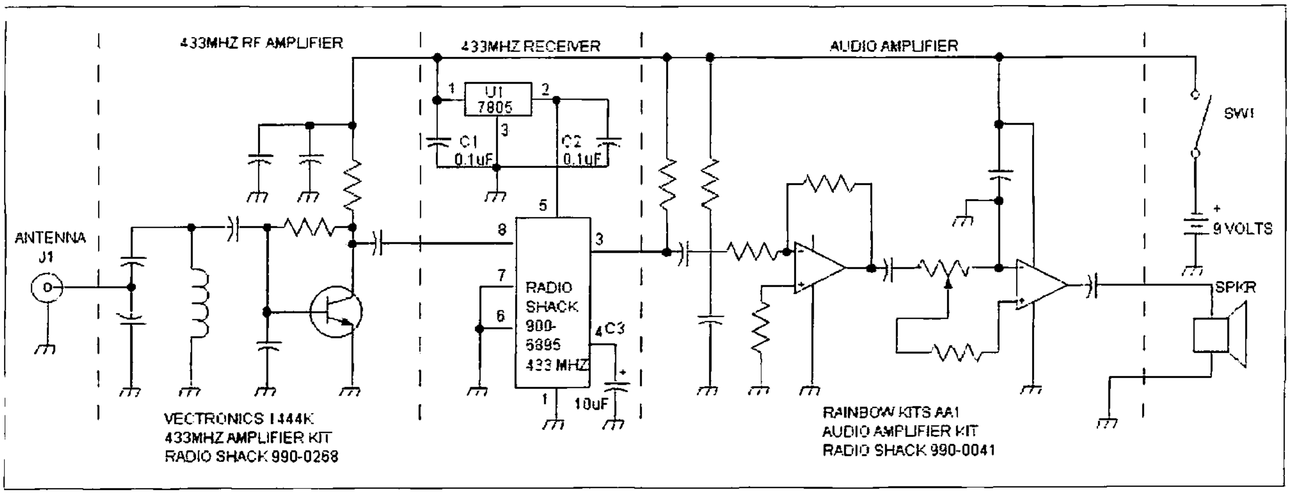


Fig. 2. Receiver schematic.

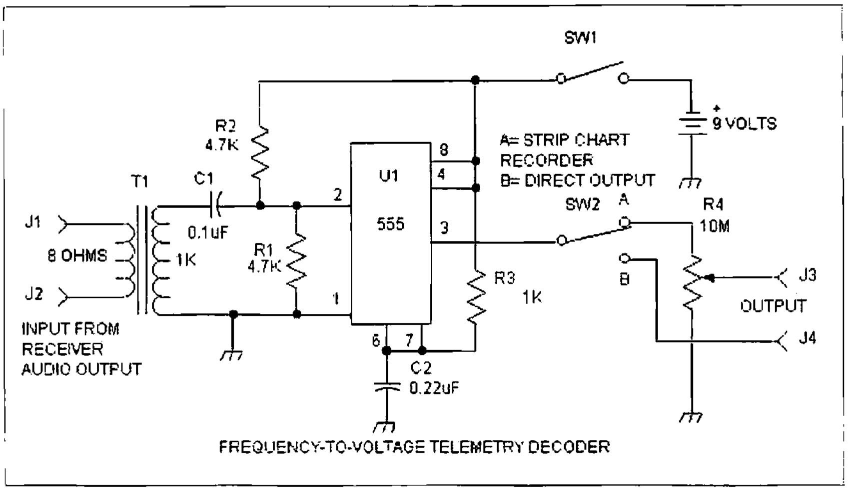


Fig. 3. Decoder schematic.

construct pulsewidth vs. temperature templates. After the flight telemetry data is recorded, the students then use the templates to "reduce" the telemetry data by converting pulsewidth to temperature. During the flight of the rocketsonde, some of the students use theodolites to shoot angles on the rocket in flight. Later, the students use trigonometry to calculate the altitude of the rocketsonde vs. time. The students then combine the two sets of data to construct a graph of air temperature vs. altitude.

Construction of the transmitter

An approximately six-inch by one-inch printed circuit board is used for the transmitter. A full-size reproduction of the circuit board foil pattern is shown in **Fig. 5**. The first steps are to assemble all the modulator components on the board. **Figure 4 — Component placement diagram (transmitter).** Make sure to save all of the component lead cuttings, as you will need some of them a bit later. Note that the leads of capacitor C2 (4.7 µF electrolytic) are left a bit long so that it can be bent over the integrated circuit U2. This is necessary to allow the assembled unit to fit into the rocket payload housing.

A short piece of hookup wire is connected to the free lead of capacitor C3 (0.1 µF disc ceramic), and the other end of the wire is soldered to the PC board as shown in the component location diagram. Take one of the longer component lead cuttings and slip the ferrite bead over the wire. Shape as shown in the component location diagram, and solder in place. It is important that the ferrite bead be placed close to the positive bus end of the wire, and the remaining wire is dressed close to the surface of the board.

The next step is to install the transmitter module. This module must be installed with the large round can on the board facing away from the modulator section. This will ensure the correct pin sequence on the board. Make sure that the bare power lead with the ferrite bead does not contact any part of the transmitter module.

Turn the PC board over to the foil side. Solder capacitors C4 and C5 (0.1 µF and 100 pF disc ceramic) between the positive power pad and the ground bus. It is important that you use zero lead length when soldering the capacitors in place. The next step is to fabricate the RF shield. Cut a 17mm by 19mm rectangle from a sheet of .005 brass. Solder three of the scrap component leads to the brass plate as shown in the shield detail. Mount the shield to the board and solder in place. Ensure that the plate does not contact the transmitter module.

The Vectronics 1444K RF amplifier kit is assembled per the instructions supplied with the kit. When winding the three-turn coil, make sure to keep the turns close together. Once the Vectronics kit is assembled, scrap component leads will be soldered to the Vectronics kit to convert it to a module that can be mounted on the transmitter PC board. You will need five lengths of scrap lead material.

Solder the leads in place so that most of the lead projects below the foil side of the Vectronics PC board. Make sure to cut off any small excess lead lengths

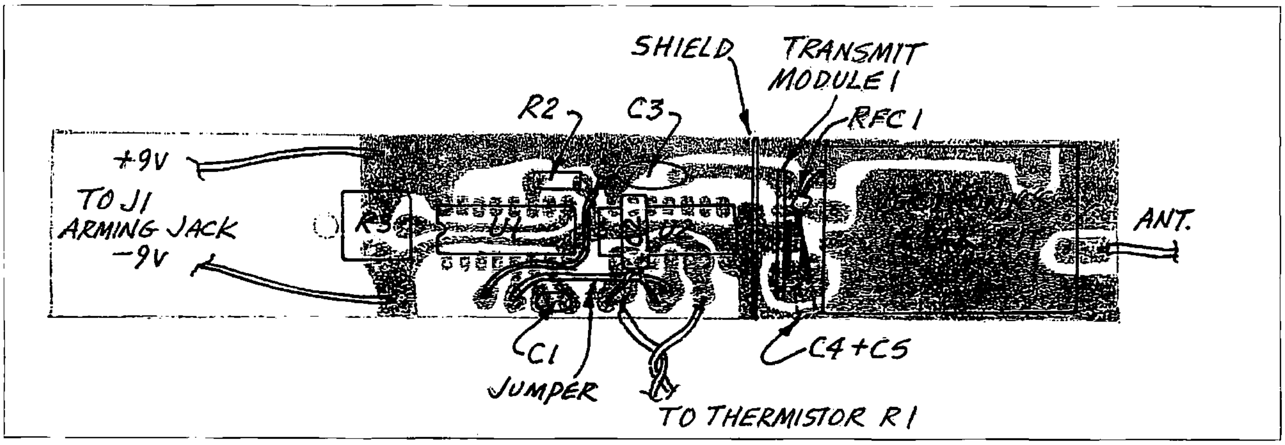


Fig. 4. Transmitter component placement diagram.

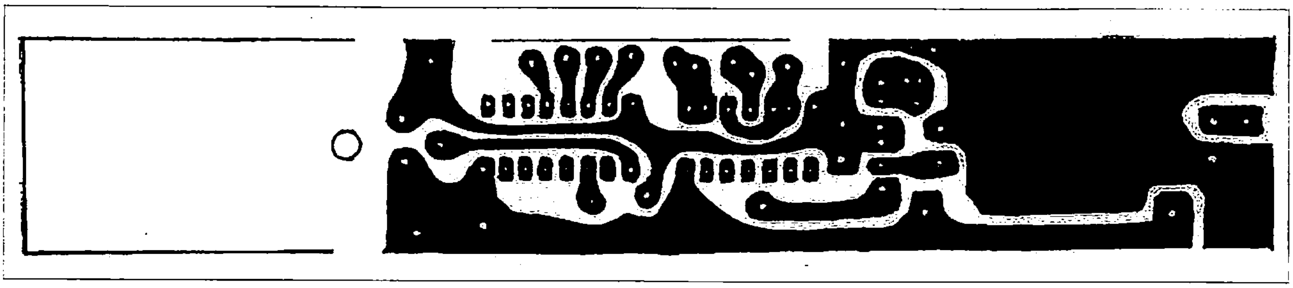


Fig. 5. Transmitter board, foil side.

that project above the component side of the board. Position the Vectronics board in place, inserting all the prefabricated leads in the holes in the transmitter board. Make sure that the Vectronics PC board is as close to the top surface of the transmitter PC board as possible.

Solder all the leads in place and cut off all excess lead length on the foil side of the transmitter board.

Prepare a three-inch length of hookup wire. Solder one end to the RF amplifier output pad on the transmitter PC board. Solder the free end to both pins of a two-pin connector. This is the transmitter antenna connection. As shown on the transmitter board component layout diagram, solder the black wire from the battery snap connector to the negative power bus on the transmitter PC board.

Prepare three-inch and six-inch lengths of red hookup wire. Slip a short length of heat shrink tubing over the shorter length of red hookup wire. Splice one end of the three-inch length of red wire to the red wire from the battery snap connector. Slide the heat shrink tubing over the solder joint and, using the barrel of the soldering iron, heat shrink in place. Solder the free end of the three-inch red wire to one terminal of the arming jack. Solder one end of the six-inch red wire to the switched terminal on the arming jack. If you are not sure which is the switched terminal, use an ohmmeter to check for continuity. When the plug is inserted in the jack, the switched terminal will be open; it will be closed when the plug is removed.

As shown on the transmitter PC board layout diagram, solder the free end of the red wire to the positive power bus on the transmitter PC board. If you wish, you can cut the two red wires from the arming jack and install a two-pin connector. This will make for easier installation of the transmitter package into the payload airframe.

Prepare two seven-inch lengths of green hookup wire. Twist the two wires together to form a "twisted pair" about six inches long. As shown on the transmitter board layout diagram, solder the two wires on one end of the "twisted pair" to the points indicated on the transmitter board layout diagram.

Solder the two free ends of the "twisted pair" to a two-pin connector. This is the connection point for the thermistor temperature sensor. The thermistor will be mounted to the outside of the payload airframe and is connected when the transmitter package is installed in the payload airframe section. This completes assembly of

Continued on page 14

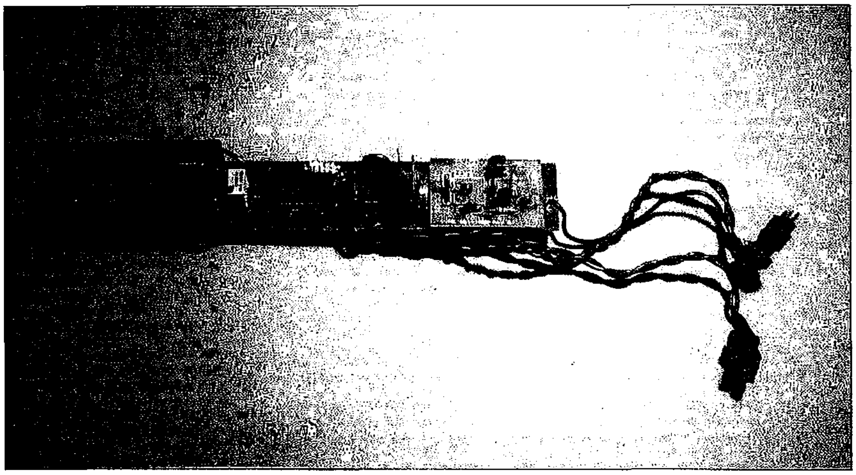


Photo A. Telemetry transmitter.

Way Cool Rocket Project, Part 1

continued from page 13

the telemetry transmitter. **Photo A** shows the telemetry transmitter.

Construction of the Receiver

Like the transmitter, the telemetry receiver is assembled on a printed circuit board. A full-size printed circuit foil pattern for the receiver PC board is given in **Fig. 7.** The first step is assembly of the Vectronics 1444K RF amplifier kit and the Rainbow Kits AA-1 audio amplifier kit. Make sure to save all the scrap component leads.

Figure 6 — Receiver component placement diagram. Assemble the RF amplifier and audio amplifier as detailed in the instructions included with each kit. NOTE: When winding the three-turn coil for the RF amplifier, keep the turns close together.

Using some of the scrap component leads, solder a wire lead to the input, output, and power points on both the RF and audio amplifiers. Make sure that most of the wire lead projects out from the foil side of the PC board. Cut off the exposed end of each lead from the component side of the board. Check to see that the soldered leads match with the holes in the receiver PC board. Install both the RF amplifier

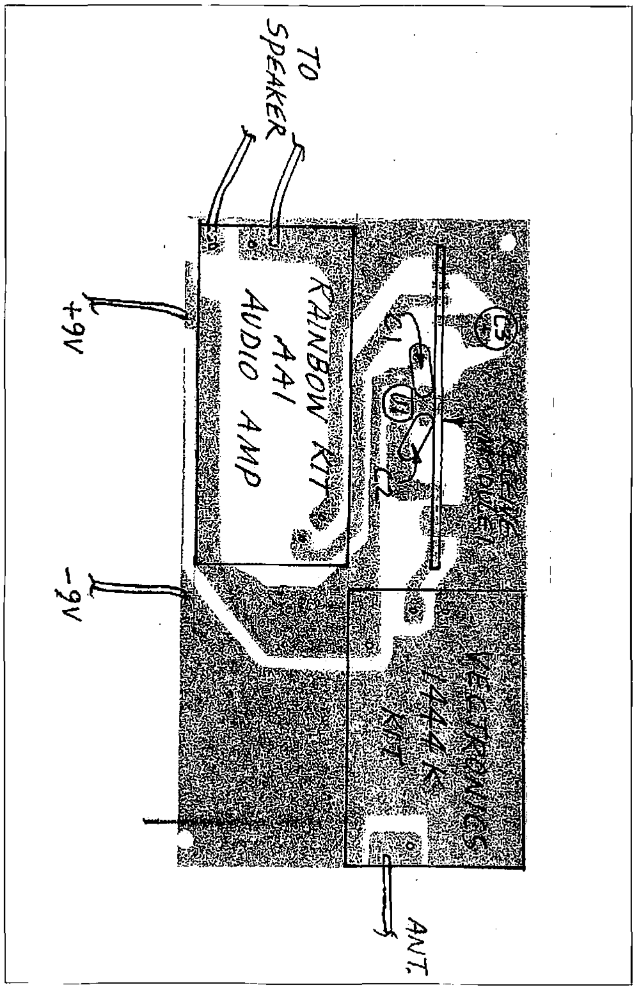


Fig. 6. Receiver component placement diagram.

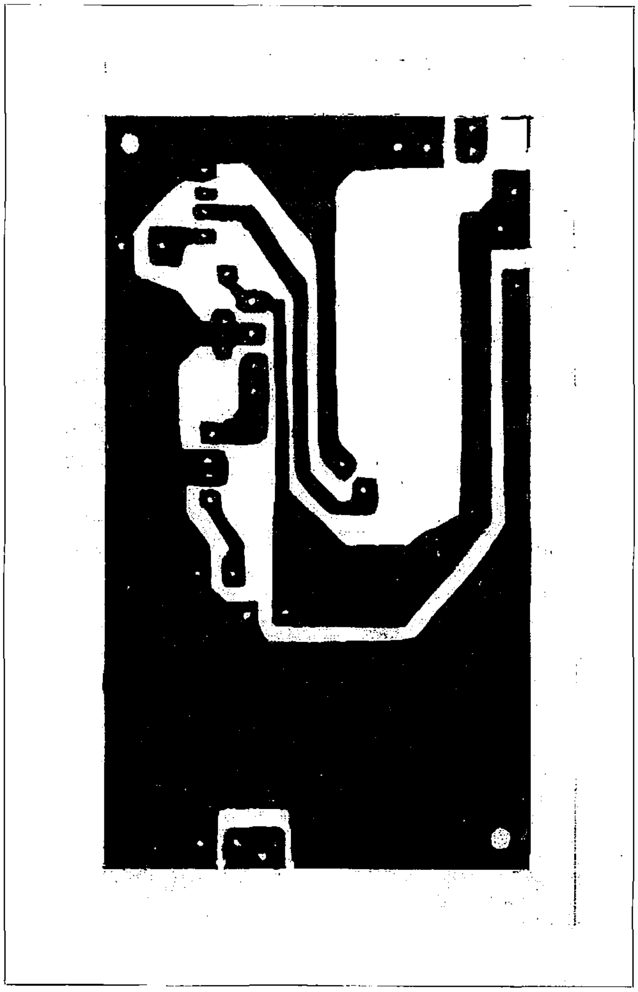


Fig. 7. Receiver board, foil side.

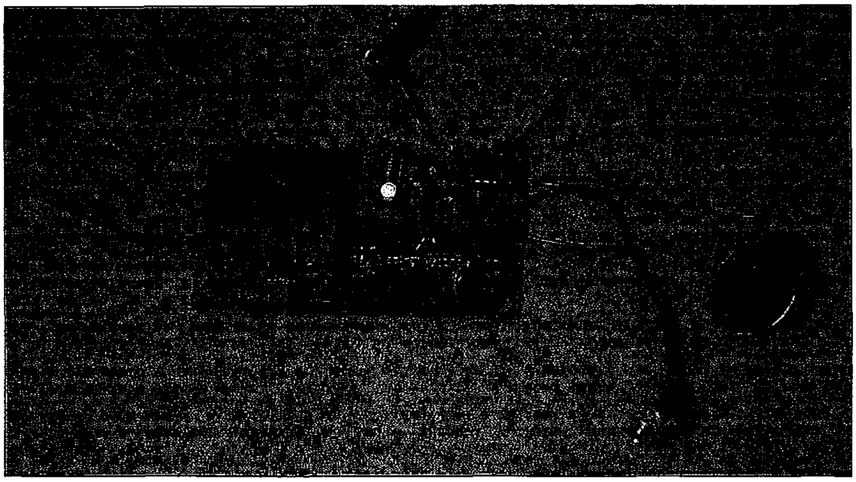


Photo B. Completed receiver board.

and the audio amplifier to the receiver PC board. Seat each of the circuit boards as close as possible to the component side of the receiver PC board and solder in place.

Install the receiver module so that the coil faces the audio amplifier. Position the module so that you have minimum lead length and solder in place. Next, install capacitor C3 (10 µF electrolytic). Make sure to observe proper capacitor polarity. Solder C3 in place. Install U1, the LM7805 voltage regulator IC. Make sure that the flat surface on the IC case faces the receiver module. Leave the leads a bit long so that the component can be bent away from the coil on the receiver board. Solder U1 in place. Install capacitors C1 and C2 in place next to U1. Try to use the minimum lead length on these components and solder in place.

Use hookup wire to connect the speaker and output jack J2 to the audio amplifier output. Solder an SPST switch (SW1) in series with the positive lead from a 9-volt battery snap connector. Solder the battery leads to the appropriate points on the receiver PC board.

Photo B — Completed receiver PC board. I housed the receiver in a 2-inch x 4-inch x 5-inch Bud aluminum minibox. The receiver PC board is mounted on 1/4-inch aluminum standoffs and is positioned as close as possible to the antenna connector. **Photo C** shows the receiver mounted in the enclosure.

Construction of the decoder

The decoder is a simple enough circuit to be easily wired on 1/2 of a Radio Shack #276-159 "Dual General Purpose IC PC Board." Lead length and component placement are not critical in this circuit. The type of attenuator you use will depend on the input requirements of the recording device you are using. I used banana type jacks for the decoder input and output connections. **Photo D** shows the decoder mounted in its housing.

Testing and tuning

Attach a short antenna to the receiver and solder a twelve-inch length of wire to the transmitter RF amplifier output connector. Temporarily connect the thermistor to the transmitter. Plug in a blank plug into jack J1 on the transmitter. This will ensure that power is removed from the transmitter. Temporarily break the positive power lead to the transmitter and install a milliammeter in series with the positive power lead. Install a 9 volt battery to the transmitter battery snap connector. Connect a 9 volt battery to the receiver. Apply power to the receiver. You should hear a rush of static coming from the speaker.

Next, remove the plug from transmitter J1. This will apply power to the transmitter. You should see about 10 milliamps of current to the transmitter. At the same time, you should hear tone pulses in the speaker. Use the point of a wooden toothpick to gently separate the turns on transmitter power amplifier coil. Go easy here, as the adjustment required is small.

Adjust for maximum signal strength from the speaker. Use the same technique to adjust turn spacing on the receiver RF amplifier coil. Again, adjust for maximum signal strength. Power down the transmitter and receiver and reconnect the positive power lead in the transmitter.

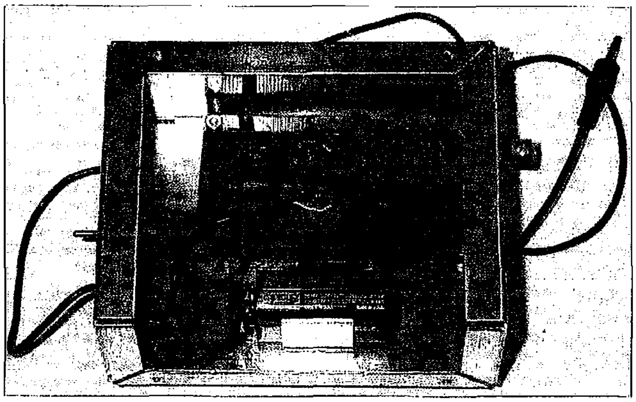


Photo C. Receiver mounted in the enclosure.

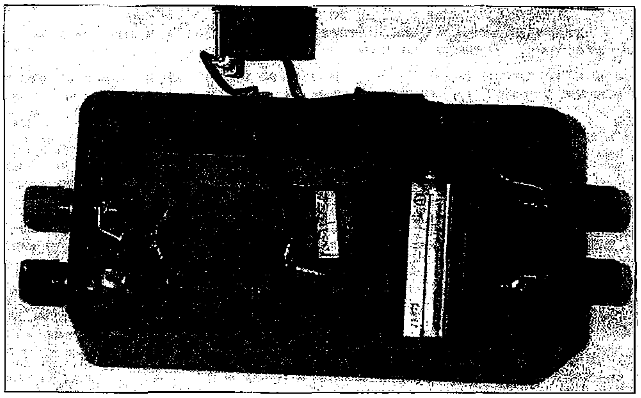
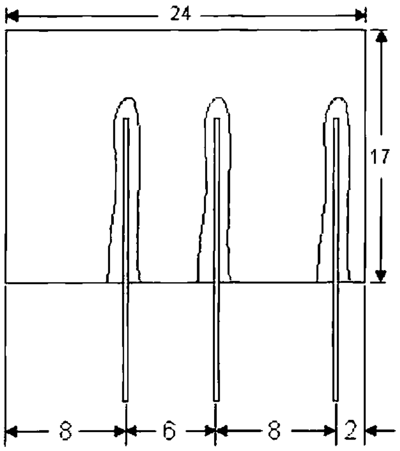


Photo D. Decoder mounted in its housing.

NAME	DESCRIPTION
Transmitter Parts List	
C1, C3, C4	0.1 µF disc ceramic cap. RS #272-135
C2	4.7 µF electro cap. RS #272-1024
C5	100 pF disc ceramic cap. RS #272-123
R1	Thermistor, RS #271-110
R2	100k 1/4 W resistor, RS #271-1347
R3	500k pot, Mouser #72-T70YP-500k
J1	1/8-in. open frame closed circuit jack, RS #274-246
J2, J4	Thermistor connector, 2-pin Deans ultraplug, Deans #1300 (available from R/C suppliers)
J3	9 V battery snap connector, RS #270-324
Module 1	433 MHz AM transmitter module, RS #900-6896
Vectronics 1444K RF amp kit	433 MHz, RS #990-0268
U1	4011B CMOS quad NAND gate, Digi-Key #CD4011BCN-ND
U2	4045 micropower PLL, Digi-Key #CD4046BCN-ND
RFC-1	Ferrite bead, Mouser #542-FB64-110
Misc. components: 0.005-in. sheet brass; PC board	
Receiver Parts List	
C1, C2	0.1 µF PC-mount cap, RS #272-1069
C3	10 µF electro cap, RS #RSU11296852
U1	7805 IC +5 V regulator, RS #276-1770
Module 1	433 MHz AM receiver module, RS #900-6895
Vectronics 1444K RF amp kit	433 MHz, RS #990-0268
Rainbow Kits AA1 audio amp kit	RS #990-0041
SW1	SPST mini toggle switch, RS #275-624
J1	BNC chassis-mount jack, RS #278-105
J2	2-conductor open frame jack, RS #174-251
Spkr	1.1-in. mylar mini speaker, Mouser #253-5011
Misc. components: 9 V battery snap (RS #270-324); 9 V battery holder (RS #270-326); aluminum minibox; PC board	
Decoder Parts List	
C1	0.1 µF cap, RS #272-1069
C2	0.22 µF cap, RS #272-1070
R1, R2	4.7k 1/4 W resistor, RS #271-1330
R3	1k 1/4 W resistor, RS #271-1321
R4	5 meg pot, linear taper, Mouser #31VC605
T1	Audio transformer, RS #273-1380
U1	LM555N IC timer, RS #276-1723
SW1	SPST toggle switch, RS #275-624
SW2	SPDT toggle switch, RS #275-625
J1, J2, J3, J4	Banana jacks, RS #274-661
Misc. components: 9 V battery snap (RS #270-324); 9 V battery holder (RS #270-326); small plastic box; PC board (RS #276-159)	
Component Suppliers	
NAME	**URL**
Radio Shack	www.RadioShack.com
Digi-Key	www.digikey.com
Mouser Electronics	www.mouser.com

Part 2 of this three-part series will discuss integration of the transmitter electronics package into the sounding rocket payload section and construction of the telemetry tracking antenna. Have fun!



SHIELD DETAIL
(MEASUREMENTS IN MM)

Fig. 8. Shield detail from Fig. 1.

Table 1. Parts lists.

Parker R. Cope W2GOM/7
8040 E. Tranquil Blvd.
Prescott Valley AZ 86314

All About Class D Amplifiers

What you do know can't hurt you.

A class D amplifier is a high efficiency amplifier whose efficiencies can be greater than 90%. Some authors restrict class D amplifiers to amplifiers with constant duty cycle, and reserve class S for pulsewidth-modulated (PWM) amplifiers. By whatever name, the amplifiers have very high efficiencies. Just to put us on the same page, I'll call them all class D.

When vacuum tubes were the only active devices, amplifiers were classified as A, B, or C, depending on their conduction angles. For example, a class A amplifier conducted for 360 degrees of the input signal and efficiency could never exceed 50%. A class B amplifier conducted for about 180 degrees and had a maximum efficiency of 78.5%. A class C amplifier conducted for less than 180 degrees and had an efficiency of about 65% to 85%. While other modes of operation were known to the academics, the limitations of tubes restricted their practical application to these three classes.

An in-between class of operation that is appropriate for vacuum tubes is class AB. In class AB the push-pull connection eliminates even harmonics, and makes it possible to extend operation until the instantaneous plate current is reduced to zero for a small portion of each cycle without causing excessive distortion in the output. Class AB amplifiers have efficiencies in the order of 40 or 50%.

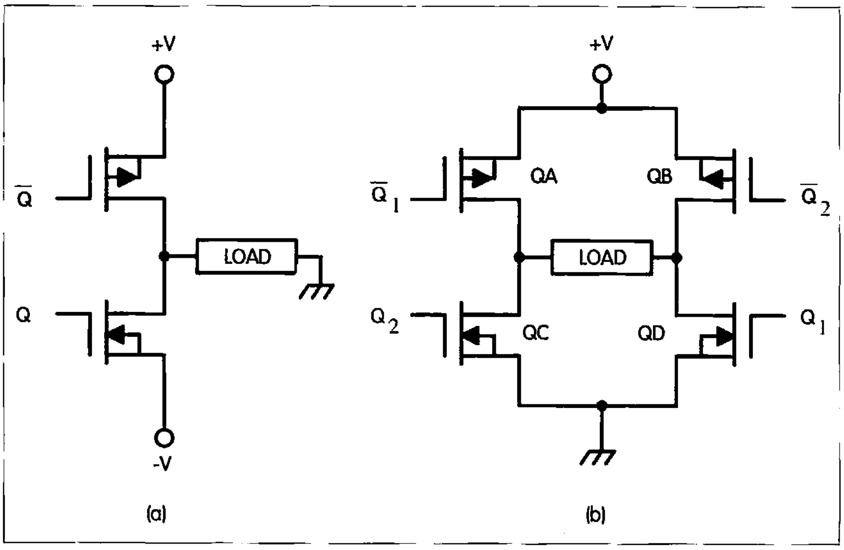


Fig. 1. (a) A half-H switch needs balanced power supplies. (b) A full-H needs a single supply.

Because tubes can have short term dissipation exceeding the rated plate dissipation, class AB was used to squeeze a little more power out of a tube. As an aside, a further distinction of amplifiers was denoted by the subscript 1 or 2 which indicated whether grid current flowed. The subscript 1 meant no grid current and is assumed unless otherwise noted. The subscript 2 meant there was *some* grid current. Class A_2 or AB_2 indicated that grid current flowed (with an attendant increase in distortion). Because the cost of a tube was significant, every effort was made to reduce the tube count and get the most from every stage. Today the cost of the passive components in a circuit outweigh the cost of the semiconductor and no great effort is expended in reducing the transistor count.

Class G amplifiers are a high efficiency class of amplifier that has a maximum efficiency of 84.2%. A complementary class G amplifier requires two power supplies and uses

four transistors, instead of the two used in class B. One pair of transistors operates from a lower supply voltage (e.g. $\pm 1/2\ V_{cc}$). The first pair of transistors work for low level signals and the second air operates when the input signal exceeds what the first pair can handle. The scheme was described by L. Feldman in "Class G High Efficiency Hi-Fi Amplifiers," in *Radio Electronics,* August 1976. The scheme has enjoyed little success.

The class of operation of an amplifier cannot be divined by just looking at the schematic — it depends on the operating point. For example, the schematic of a class B amplifier looks very much like the schematic of a push-pull class A amplifier, but a class D amplifier is unique.

Power semiconductors have opened many of the formerly esoteric amplifiers to practical uses. Class D amplifiers are an example of a high efficiency class of amplification made practical by semiconductors. Class D amplifiers are basically switches that are either open or closed. When off, the semiconductors conduct no current and dissipate no power. When on, the drop is less than a volt even when conducting amps, and they dissipate little power. On the other hand, vacuum tubes need a plate voltage in the order of a hundred volts to conduct even a moderate current. In short, tubes don't make good switches.

Since the transistors in a class D amplifier are either on or off, they aren't suitable for linear applications as such. But, the average of a PWM signal can be proportional to a varying audio input, and the PWM signal can control efficient power semiconductor switches. Class D amplifiers routinely have efficiencies approaching 95%.

Pulsewidth modulation is widely used in switch mode power supplies (SMPS) to produce a regulated unipolar voltage. The output DC voltage is compared to a reference voltage to produce a PWM signal and the pulsewidth changes to correct the output voltage.

While either MOSFETs or BJTs can act as the switch, the MOSFET is preferred because of its higher switching speed and lower drive requirements. High switching speed is desired because

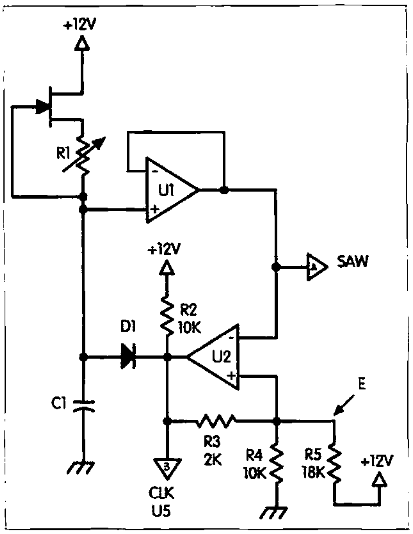


Fig. 2. PWM uses a linear sawtooth.

a high switching frequency reduces the inherent distortion in the recovered signal. A switching frequency ten times the highest audio frequency is sufficient for distortions below 40 dB. Therefore a 20 kHz audio signal requires a switching frequency of 200 kHz or greater. 3 kHz communications audio only requires a switching frequency of 30 kHz.

The efficiency of the switch is ultimately determined by the internal resistance of the switch transistor(s) and the load resistance. When R_S is the switch resistance, the efficiency η is:

$\eta = P_L/(P_L+P_s) = R_L/(R_L+R_S)$

where R_l is the resistance of the load and R_S is the saturation resistance of the transistor(s). For high efficiencies, R_S must be low compared to the load. The internal resistance of a MOSFET is R_{DSon} and the internal resistance of a BJT can be calculated from V_{CESAT} and the collector current I_C, $R_S = V_{CESAT}/I_C$.

An internal resistance of even 0.1 Ω and a 4 Ω load has the potential of achieving an efficiency of about 95%. Recent MOSFET introductions have R_{DSon} of a few milliohms. Since the power dissipated in the transistor is only I^2_{RDSon}, heat sinking of the transistors is seldom needed.

The BJT has a lower collector/emitter saturated voltage and dissipation than the R_{DS} and dissipation of a MOSFET. But this advantage is usually overridden by higher base drive current and delays when turning off the saturated BJT. It's not a simple trade-off.

A price is extracted for using a high switching frequency: The gate drive current for the MOSFET switch becomes a serious consideration for any fast or high frequency application.

Even though the MOSFET is a voltage-controlled device it takes time to charge the input capacitance and affect a switch. The rate of change of voltage with respect to time across the a capacitance may be expressed as:

$dV/dt = I/C$

where I is the charging current in amps and C is the capacity being charged in Farads, t is in seconds. The effective input C of a FET is not obvious.

The input capacity of an FET is more than just the static gate/source capacity, C_{gs}, plus the gate/drain capacitance, C_{gd}. The input capacitance is increased by that old bug-a-boo: "Miller effect." Miller effect is the phenomenon by which the feedback path between input and output provided by the interelectrode capacitance C_{gd} increases the apparent input capacitance.

The input capacitance of an amplifier can be expressed as:

$C_{in} = C_{gs}+C_{gd}(1+A\cos\phi)$

where ϕ is the phase angle of the drain load. When the drain load is a resistor, ϕ is 0° and $\cos\phi = 1$. Therefore, when the load is resistive, $C_{in} = C_{gs}+C_{gd}(1+A)$.

Another uncertainty of the input capacitance of a transistor is the variable nature of C_{gd}. C_{gd} of a transistor is not a constant value like a tube's plate-to-grid capacity. The grid/plate capacitance of a tube depends on the physical construction of the tube which is constant, while the gate/drain capacitance of a transistor is dependent on the voltage across the gate/drain junction. As the reverse junction voltage increases, the static junction capacitance decreases. This change in capacitance with voltage is referred to as the varactor effect or the parametric capacitance. The parametric capacitance introduces a complication in determining the capacitance to be charged.

Most power MOSFET manufacturers specify a "total gate charge," Q_T, needed to raise the gate voltage sufficiently to just saturate the drain for the particular drain voltage and rated drain current:

$Q_T = i_g t$

Where i_g is the gate input current in amperes and t is time in seconds needed to charge the gate capacitance. 25 mA into a Q_T of 10 nC (nano-Coulombs)

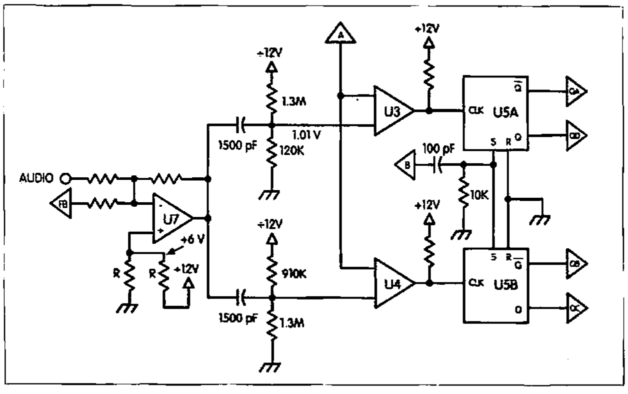


Fig. 3. The variable pulsewidth is obtained by comparing the sawtooth with the audio.

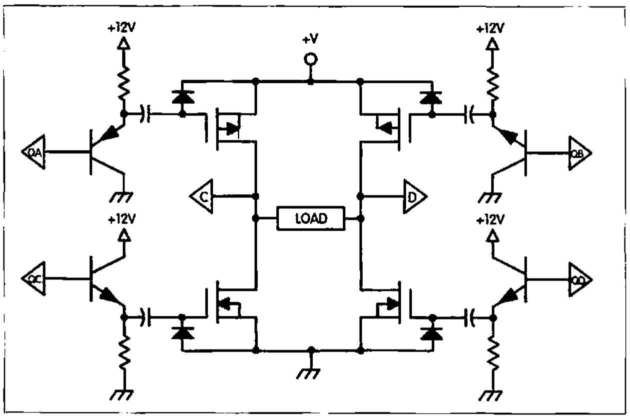


Fig. 4. The drive to high voltage MOSFETs is capacitively coupled.

will change the gate 2.5 V in 1 μsec. The gate drive current is a spike of current that exponentially trails off to zero as the input capacitance becomes charged.

Since the total gate charge is that charge which is required to just switch the device, prudencc indicates that overcharge capability be provided. A safety factor in the charging current of two to one is not unreasonable. The compliance of the gate drive current must also be greater than the gate voltage required to saturate the drain current. Most power MOSFETs require a gate voltage in the range of 5 to 10 V to saturate the drain current, but some devices switch with voltages as low as 2.5 V. The charging current then must come from a voltage of 2.5 V to maybe 10 V.

The time needed to charge the gate capacity is important because during the rise and fall of gate voltage, the drain voltage and current are nonzero and power is dissipated in the drain. As a result, the gate drive current influences the efficiency for a particular frequency. A rise/fall time that is 10% of the total period increases the dissipation by a tolerable amount. For example, a 10% rise and fall time decreases an efficiency of 95% to about 94%.

The configuration of the power switch is usually a full-H as shown in **Fig. 1(a)**. When transistors QA and QD are on, current flows in the load in one direction. When QB and QC are on, load current flows in the other direction. For the sake of argument, let's say current flows in QA and QD represent the positive half of the output cycle and QC and QB represent the negative half cycle.

A full-H has the advantage of producing a peak-to-peak output voltage that is nearly twice the single supply voltage. However, a full-H requires complementary MOSFETs and complimentary gate drives. A negative pulse on QA's gate and a positive pulse on QD's gate allows current to flow in one direction in the load. Load current reverses when QB and QC conduct.

A full-H with a 12 V supply has a peak-to-peak load voltage of almost 24 V_{pp}, and the maximum power output to a 4 Ω load will be about $V_{rms}^2/4$ or 18 W_{rms}. A half-H shown in **Fig. 1(b)** requires balanced positive and negative supplies and produces an output of

$(V_+ + V_-)2/2R_{load}$.

When the transistors have an R_{DSon} of 0.1 Ω, transistor dissipation ($I_{rms}^2 R_{DSon}$) will be about 0.15 W. Obviously, heat sinking is not a major consideration.

If the P-channel transistors QA and QB in **Fig. 1(a)** need a drive of 5 V, they are turned on by a gate voltage of +5 V and off by 0 V. The voltage across the load essentially swings from the positive rail to ground in one direction for a positive input and in the other direction for the negative input.

While the power in the load may be high, transistor dissipation is low. For example, the current in the load and transistor is approximately E_{supply}/R_{load}. If R_{DSon} is specified as 0.1 ohm and the load is 4 ohms, the total resistance in series with the load is 0.2 ohms and 95% of the supply voltage appears across the load. If the load were 16 ohms the efficiency would be over 98% with zero transition time. If the transition time is 10%, the dissipation will increase and efficiency will drop about 1%. Heat sinking is still not much of a factor.

The PWM generator is the critical part of the class D amplifier. PWM controllers intended for power supplies or motor controllers are available from several companies and a few are intended for audio applications. But they all have the same basic internals, though they may be implemented differently.

Fig. 2 shows a generic method of generating linear PWM with discrete components: A constant current charging C1 produces a linear ramp of voltage. U1 is a unity gain buffer that isolates CI from any loading presented by the following circuits. When the voltage across C1 equals the reference voltage on comparator U2, U2's output goes to near zero and discharges C1 through D1. When U2's input is less than the reference, U2's output goes to +12 V and allows C1 to charge and the cycle repeats. The positive transition of U2's output sets the flip-flops U5A and U5B in **Fig. 3**.

The sawtooth is compared with the audio in comparators U3 and U4,

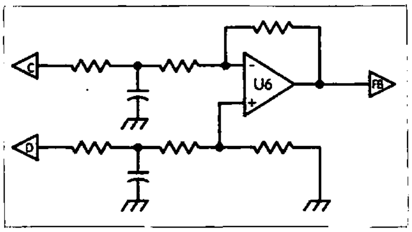


Fig. 5. A differential amplifier converts the floating output to single-ended.

shown in **Fig. 3**, to produce a pulse whose width is proportional to the audio amplitude. U7 provides the gain needed to raise the audio input to about 6 volts peak for use by U3 and U4. U7 also sums the input with the output fed back from U6 for comparison with the input.

The constant current charging C1 is produced by the JFET Q1. R1 in the source of Q1 controls the charging current and consequently the rate of rise of the voltage across C1. The hysteresis of comparator U2 controls the amplitude of the sawtooth. After the amplitude is established by U2, R1 can be adjusted to produce the required frequency. The hysteresis in U2 controls the amplitude of the sawtooth; the current in Q1 controls the rate of rise of the voltage across C1.

For the values shown in **Fig. 3**, the noninverting input of U2 swings from a low, E_{lo}, of about +1 V to a high, E_{hi}, of about +7 V. A swing of about 6 volts. Therefore, the output of U2 switches at inverting inputs of +1 V and +7 V. When the ramp of voltage applied to the inverting input rises to the voltage on the noninverting input, +7 V, the output of U2 goes to zero, and C1 is discharged to near zero through D1. When the voltage on C1 falls to 1 V, the output of U2 switches to +12 V, D1 becomes reverse-biased, and the voltage on C1 rises from about +1 V to about +7 V and the cycle repeats. The positive rise of the output of U2 also resets the flip-flops U5A and U5B.

The hysteresis of U2 and the ramp amplitude can be changed by choosing different values for R2, R3, and R4 and the voltage E at the inverting input can be calculated. When the output of U2 is low, essentially zero, the noninverting input is:

$$E_{lo} = 12x(R3^{-1}+R4^{-1})^{-1}/(R4^{-1}+R3^{-1})^{-1}+R5.$$

When the output of U2 is high, the noninverting input is:

$$E_{hi} = 12x[R5^{-1}+(R2+R3)^{-1}]^{-1}/\{R4+[R5^{-1}+(R2+R3)^{-1}]^{-1}\}.$$

The comparators U3 and U4 compare the voltage ramp to the audio. When the offset audio exceeds the ramp voltage, the comparator switches and produces a pulse whose width is proportional to the audio amplitude. The audio is capacitively coupled to U3 and U4 to remove any DC that may exist on the audio.

The audio input to U3 is offset to +1 V and the positive half of the audio raises the input to U3 above 1 V, and the output switches to +12 V. The audio input to U4 is offset to +7 V and when the negative half of the audio input makes the input less than the sawtooth, U4's output switches.

The positive transition of U3 and U4 triggers U5. The outputs of U5B drive the QB and QC sections of the switch, and the outputs of U5A drive the QA and QD sections of the switch. The flip-flops are reset by the positive transition of U2 when the sawtooth starts its rise. The outputs of U5 drive the switches.

When U5 is a CD4013, the output current is limited so that some current gain must be provided to drive MOSFETs with high Q_T. A 2N3906 PNP emitter follower can be used to drive the P-channel MOSFET and a 2N3905 NPN can be used to drive the N-channel MOSFET. These transistors have h_{fe} of about 60 at 1mA of base current and can supply significant peak currents to drive rather large MOSFETs.

The voltage across the load essentially floats; one side is grounded for positive signals while the other side is grounded for negative signals. This balanced signal is converted to single ended in U6 for feedback to the input of U7 as shown in **Fig. 5**. U6 can also scale the voltage to a range suitable for U7.

The voltage across the load is a series of pulses that must be filtered to remove the switching components before it can be compared to the audio input. The filter is not terribly critical but it can introduce phase shifts in the recovered audio that can lead to instability when fedback. The amplifier will oscillate if the overall phase shift approaches 180° before the gain has fallen to less than one. Therefore, the low-pass filter should cut-off below the switching frequency but well above the highest audio frequency. Ideally, the phase shift should be no more than about 150° at the highest audio frequency.

Kilowatt amplifiers require power supplies in the range of a couple of hundred volts and several amps. The drive required is still only ten volts or so, and the peak gate current will seldom need to be greater than 100 mA. A drive current of 70 mA can switch a MOSFET with a total gate charge of 70 nC in 1 µs.

Shifting the drive to the 200 volt gate voltage of the P-channel MOSFET requires capacitive coupling. **Fig. 4** shows how this can be accomplished. The diodes clamp the gate drive to the high voltage. The coupling capacitors should be large compared to the gate input capacity. But remember, it is the switching frequency being coupled, not the audio frequencies. 0.1 µF capacitors with appropriate voltage ratings should do the job.

Class D amplifier ICs are available that perform the PWM and drive speaker resistances. The Linfinity Microelectronics' LX1720 is a stereo unit that produces 20 W per channel. The data sheet says THD + noise is less than 1% over the 20 Hz to 20 kHz frequency range. Linfinity has a monophonic unit, the LX1710, with power capability of 50 watts that should be available by the summer of 2000. TI also has a monophonic class D IC amplifier, the TPA032D01, that has an output of about 10 W. The IC was designed to drive MOSFETs with Q_T of 10 nC so they have rather limited output current capabilities. For high power, high voltage applications, capacitive coupling and some current gain is in order. The emitter followers are appropriate here as well. While the

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Portable Personal Repeater

Handy, inexpensive, and fun!

I know all of us dedicated hams just love to stay in contact wherever we go. A true ham never even thinks about going anywhere without his/her HT (handie-talkie). Here in the Bay Area, there are so many repeaters that you can always find a group that fits your fancy. Not only is it fun, but an HT is a jewel when an emergency occurs. They come in very handy on camping trips, snow trips, or in the mountains.

If you're lucky, there will be a repeater always within range. In most big vacation resorts, that may be the case. But if you go deep into the woods in the middle of nowhere, then you may not be within range of a repeater. What's the solution? There are many, but my solution had to be portable, lightweight, low-cost, and easy to build, with good performance. How about a fully self-contained portable crossband repeater for almost no cost? Sound impossible? Read on.

How are all these requirements met? First of all, most full-blown repeaters cost in the range of several thousand dollars. They involve a high-quality receiver, transmitter, controller, and an expensive duplexer. A duplexer is basically a very high-Q resonant cavity which isolates the transmitter from the receiver. This is necessary since the difference in transmit and receive frequencies for repeaters is only 600 kHz on VHF.

In addition, a VHF duplexer is bulky and heavy. A UHF repeater would be slightly smaller, but still impractical both in terms of cost and size. My main objective was to keep in touch with other repeaters when I visited remote sites which were not HT-accessible. Thus I needed it to be synthesized so that I could change frequencies on the fly without retuning a duplexer. The answer was a fully self-contained crossband repeater. I had to be creative, since with a family of four, I could not justify to the YL that I should spend a $1,000 on a box I would just use twice a year.

So what exactly is a crossband repeater? It is exactly that: A crossband repeater repeats not on the same band as in a conventional repeater, but on another band. In this case, VHF to UHF and vice versa. This is great, because it eliminates the need for an expensive duplexer since the two frequencies are so far apart that standard LC components in the radio are more than adequate for isolation. Most

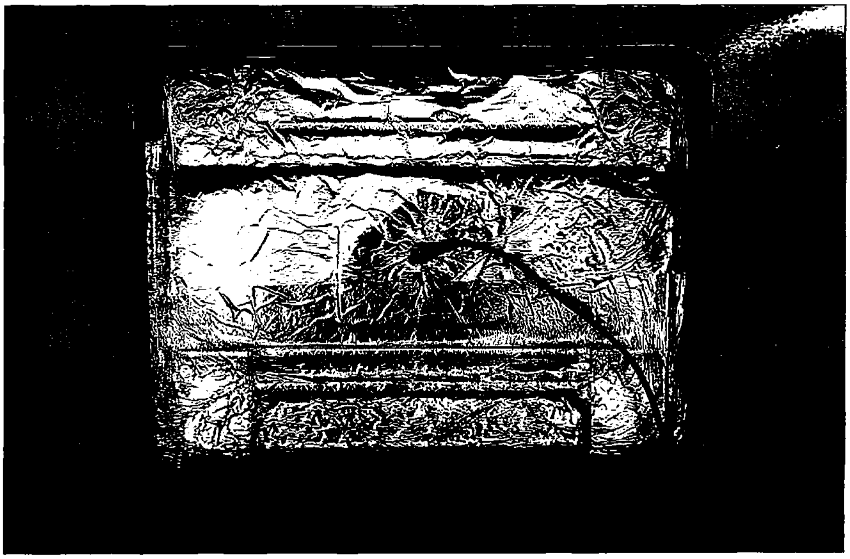

Photo A. The inside of the repeater is lined with aluminum foil, and Scotch brand spray adhesive is used to secure the foil. The foil serves as the ground for the repeater antenna.

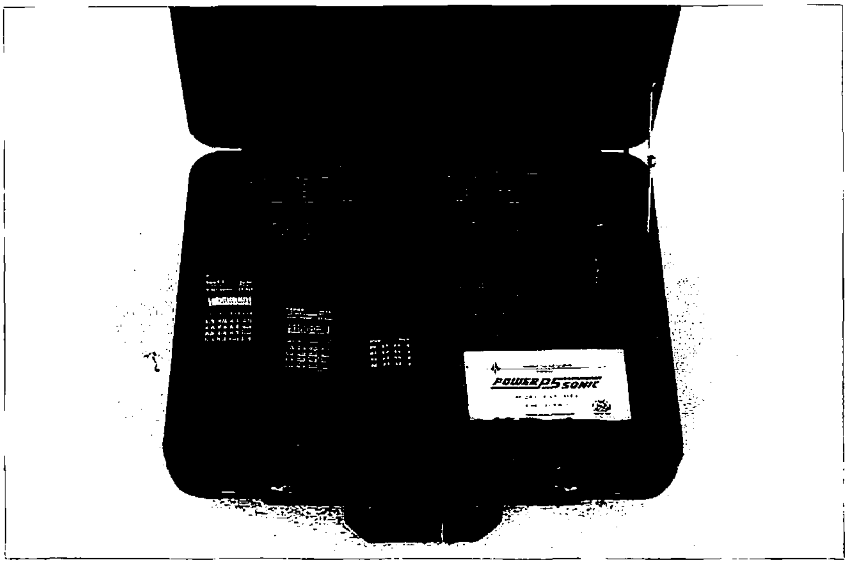

Photo B. *The crossband repeater is shown with the battery, the Alinco 580 which is used as the repeater, the two Yaesu FT-470s which are the remote radios, a power supply used for charging the battery, and a solar panel.*

dual-band HTs have this feature. Simply read the manual for your respective radio to see how it is activated. If I want to access a VHF repeater, I must use UHF on my HT and vice versa.

The first challenge was to find a cheap container to house the repeater. It had to be rugged, lightweight, and low-cost. After all, I wasn't going to spend an arm and a leg for something I would use once or twice a year. The solution: an old camcorder case. Remember how big those camcorders were just 10 years ago? These are available at surplus stores, flea markets, maybe even in your attic. Well, the camera may be obsolete, but the case is still useful. You can refoam the inside or just use the old stuff.

How about the radio? Well, I just used my Alinco 580. It doesn't have to be permanently installed — only when I need to use it as a repeater. I have several HTs, so using one as a repeater was no problem. Besides, an Alinco 580 can be bought used for under $200. I have seen these go for under $150 at flea markets.


Photo C. *Here I am setting up the repeater at 5,000 ft. Place it next to a good landmark since an overnight snow storm will easily cover up the radio.*

What about a good long-life battery? I ended up buying a brand-new 6 volt 10 amp-hours gel-cell for $15. To attach the gel-cell to the HT, I suggest purchasing the AA dry battery pack and bringing the power lines out. That adds an extra $15 if you don't already have one of these adapters. This way, everything just snaps right in place when you need to use the repeater.

Personally, I don't trust used gel-cells, so if you are serious about building a good repeater, buy a new one. I have found that many of the gel-cells sold at flea markers are batteries which are taken out of service from alarm systems after a few years of operation. Seldom do they have full capacity. It's well worth the $15 for a new battery, unless you absolutely know you have a good one to begin with.

With a 10 amp-hr battery, the Alinco 580 will transmit continuously for 12.5 hours. (I wouldn't recommend this, though, since the radio will probably burn up with continuous transmit.) The receive current is only a measly 20 mA average. Yes, only 20 mA. With a 10 amp-hr gel-cell, the receiver can operate continuously for 500 hours. That's 20 days on standby receive. With a 10% transmit cycle, or about 2.4 hours per day, you get about four days of continuous operation. Just right for a good weekend of fun.

In the same camcorder case, I even managed to fit a small solar panel that can supply about 100 mA in good sunlight. But a caution on this. Yes, it will make the battery last a little longer, but you would need at least four of these panels shown in the picture to maintain the battery indefinitely. Even then, on overcast days, it may have problems. The only exception is if the repeater is used sparingly.

What about a cheap high-performance antenna? Well, good performance, rugged, dual-band antennas are not cheap. But think again. How about using a mobile antenna? Most of us already have mobile antennas. I had a Larsen 2/70 dual-band with 3 dB on VHF and

Continued on page 59

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Inside Digital TV/VCR Tuners

Part 6: Making your own PC boards.

This is the next-to-last part in the series in the discussion of digital tuners. In this part, a simple and reliable method will be described to allow the making of printed circuit boards. Of course, some of you may already be well in front of us, having used the board layouts as provided in parts two and three of the series and gone ahead to make your own. But it is never too late for a refresher course in PCB making — or a new look at it for beginners.

Both the top and bottom sides of the data transmitter and re ceiver boards used in the project are shown again in **Figs. 1** and **2**. **Figs. 3** and **4** are provided to show the location of jumper and "Z"-wires used on the respective boards.

Over the years, many techniques and methods have been developed for making boards. Most of those methods are just out of reach of the ham experimenter. In answer to a ham's need, I'll present a process that produces boards that are very effective, reliable, and repeatable. Although the process is time consuming and perhaps archaic in some respects, it is still within the reach of most experimenters. The process produces one board at a time, but generally, that's all a ham needs to build a project. Duplicate boards can be made by repeating the process as many times as is needed. Both single and double-sided boards can be made using the process.

In the process, white bond paper (18–20 lb.) is used as a circuit transfer medium and paper mask. Fingernail polish is used as an etch resist. Once the fingernail polish has dried, the paper mask is removed and the board is then etched, drilled, and stuffed with parts. A summary of the procedure is shown in one sidebar, while another provides a listing of tools and material used in the process. **Photo A** shows a picture of the major items.

Preparing the mask

Bond paper used for photocopying is my choice of mask paper because it is the easiest with which to work in this process. The first step in the process is to make a 1:1 copy of the desired

Procedure Summary

1. Prepare a 1:1 ratio copy of the circuit trace/pattern.
2. Clean the copper on the board.
3. Coat both the paper mask and the copper with rubber cement.
4. Align the paper with the board, press down, and rub from the center to the edges.
5. Indent the hole locations for drilling using a scribe.
6. Cut along the trace lines with a knife held at a very shallow angle.
7. Remove the paper in the area of the trace. Repeat steps 6 and 7 until all of the copper trace is exposed.
8. Inspect the exposed copper.
9. Paint the copper with fingernail polish or lacquer. Attempt to keep the paint inside of the trace area.
10. Allow the paint to dry.
11. Remove the remaining paper mask.
12. Inspect and repair the trace pattern.
13. Etch the copper.
14. Remove the paint/resist.
15. Drill and clean the board.
16. (optional) Solder-coat the board.
17. Install the components.

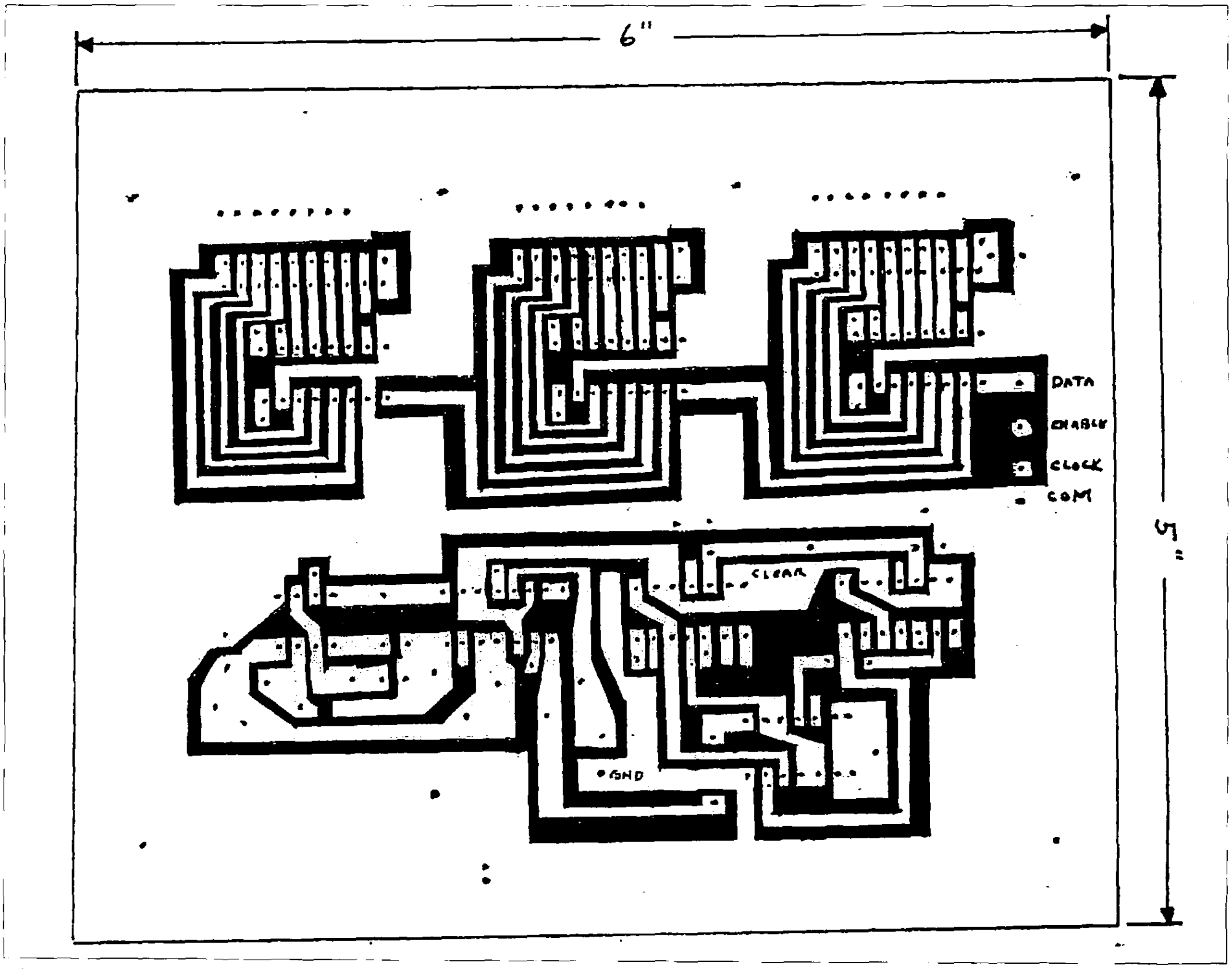

Fig. 1(a). Bottom trace view of the Data Transmitter board. The white area represents the copper, and the black area is where the copper has been removed.

circuit pattern, using any copying method that's available. By that I mean that a circuit can be hand drawn onto the paper using a pencil or can be copied using a copy machine. The circuit line edges must be distinguishable, but the density of the line is not important for this process to work.

If the circuit is being laid out for the first time, then a parts placement diagram should be made along with the circuit trace pattern. When making the circuit traces for the bottom side of the board, it is important to remember that all parts must be "viewed" from the bottom and through the board as if it was transparent. Forgetting that step causes the board to be made such that parts would have to be placed on the bottom of the board for proper orientation.

During the trace layout, as much copper as possible should be left on the board. Leaving the copper on the board has several advantages, but the two most important are that the etchant lasts longer when less copper is removed, and more copper on the board supports a lower circuit impedance. Perhaps another is that once copper is removed from the board, it cannot be replaced. It's better to have the copper and not need it than to need it and not have it.

If an original layout has been done, it should be photocopied so that it can be retained should a second board be desired. Following the trace layout, the component placement diagram should be verified as matching the trace pattern. When making the placement diagram, the board should be viewed

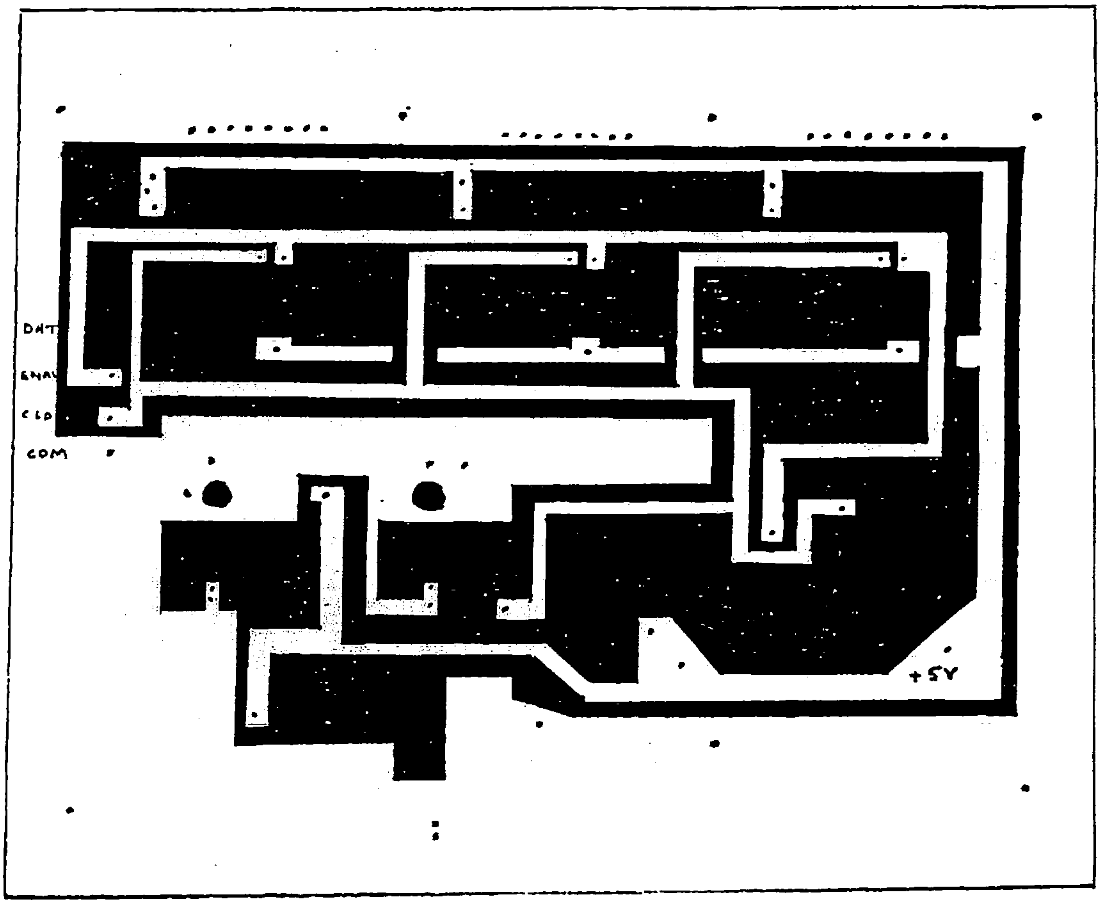

Fig. 1(b). Top trace view of the Data Transmitter board.

from the top side because that's the stuffing side. It is usually during this step that circuit errors are picked up when an original design is being done.

Preparing the board

Using the trace layout as a guide, select a board size just slightly larger than the trace pattern desired, because some misalignment usually occurs when the trace pattern is applied. Cutting the board, particularly with a saw, results in sharp, sliverlike pieces remaining along the cut edge. These slivers can cut the skin if care isn't taken when handling the board material. The board edges and burrs can be cleaned up with a file, sandpaper, or stone.

After the board is cut, clean the copper, using either a non-oil-based cleanser or fine steel wool. The objective is to remove the heavy oxides and dirt from the surface of the copper, leaving it fairly bright. Clean the board surface with alcohol, lacquer thinner, or acetone

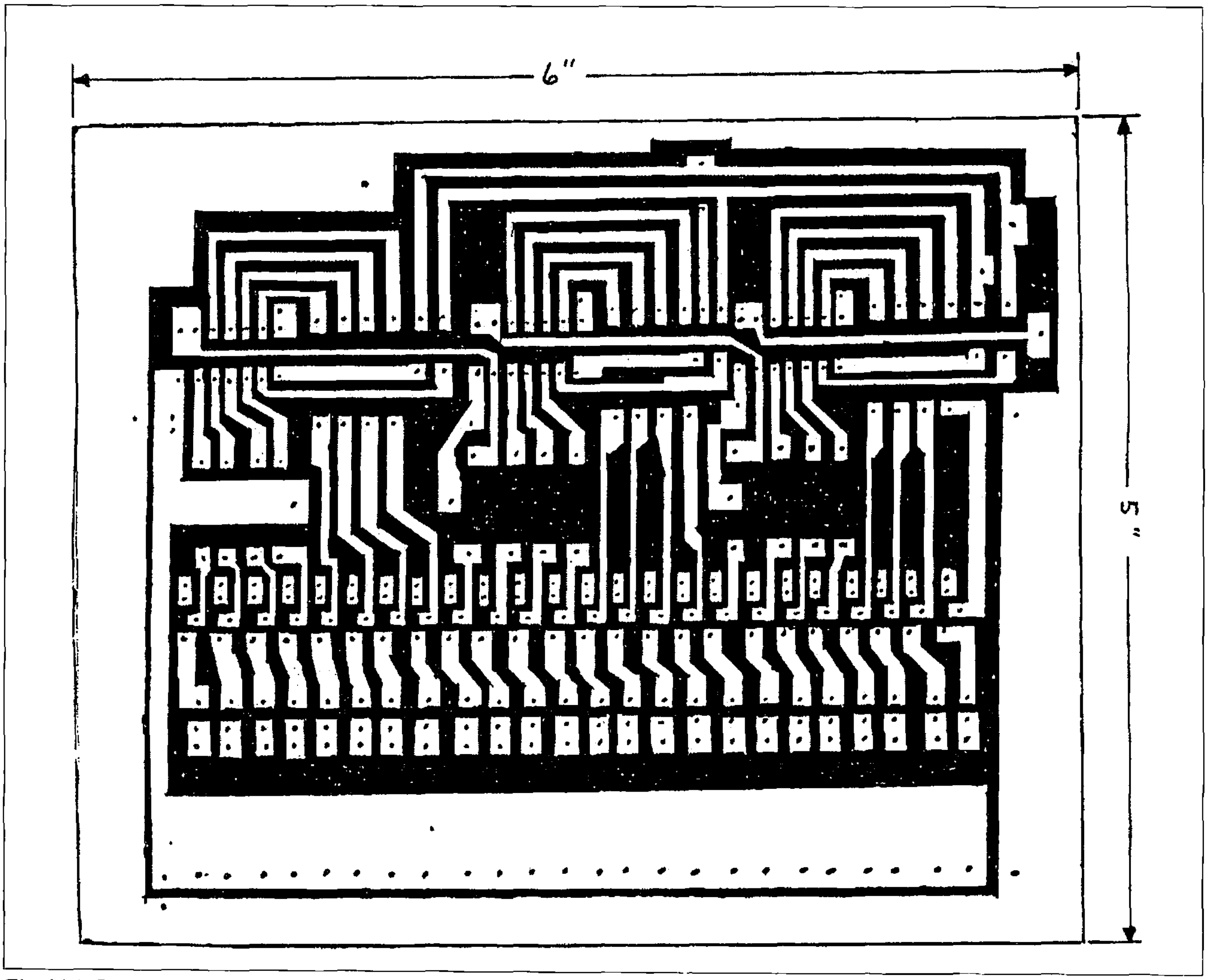

Fig. 2(a). Bottom trace view of the Data Receiver board. The white area represents the copper, and the black area is where the copper has been removed.

to remove any oil and debris that might remain. Be careful to not touch the surface with your fingers as that can deposit oil onto the copper.

Transferring the pattern

Transferring the pattern requires that the paper mask be rubber cemented to the surface of the copper and allowed to dry. Then, carefully cut out the trace pattern, using a very sharp blade.

The steps involved begin with applying rubber cement to both the copper surface and to the back side of the paper mask, leaving the trace pattern exposed. **Photo B** shows the application of cement that must cover the copper's entire surface. Before the rubber cement dries very much, align the paper mask with the board and lower the paper onto the board. **Photo C** demonstrates how the paper mask is laid down after all of the copper has been coated with cement. If wrinkles occur, the decision to remove the mask or "use it as is" must be made. If the mask can be lifted, it will be necessary to flow more rubber cement under the mask before putting it back down. If the wrinkle is not affecting any critical trace pattern or dimension, then it probably isn't going to hurt the process and can be left alone.

While maintaining the alignment of the mask, press down in the center of the paper with your fingers and rub from the center outward, removing air bubbles and lumps. Some rubber cement may be pressed out, and that's all right as the process removes excess

cement along with the air bubbles. All of the cement lumps should be removed or flattened, if any exist, leaving the paper mask flat and tight against the board.

With the mask in place, time must be allowed for the rubber cement to dry. The amount of time is dependent upon a number of factors, but waiting from 30 minutes to an hour is typical.

After the cement is dry, the spots marking where the holes are to be drilled can be lightly punched with a sharp tool. The objective here is to very lightly dimple the copper so that you can "see" where to drill the holes later on in the process. A sharpened nail, scribe, or ice pick may be used for marking the holes. Copper dimples easily so that very little effort is required. Practicing the dimpling operation on a scrap piece of board is recommended, so the amount of effort

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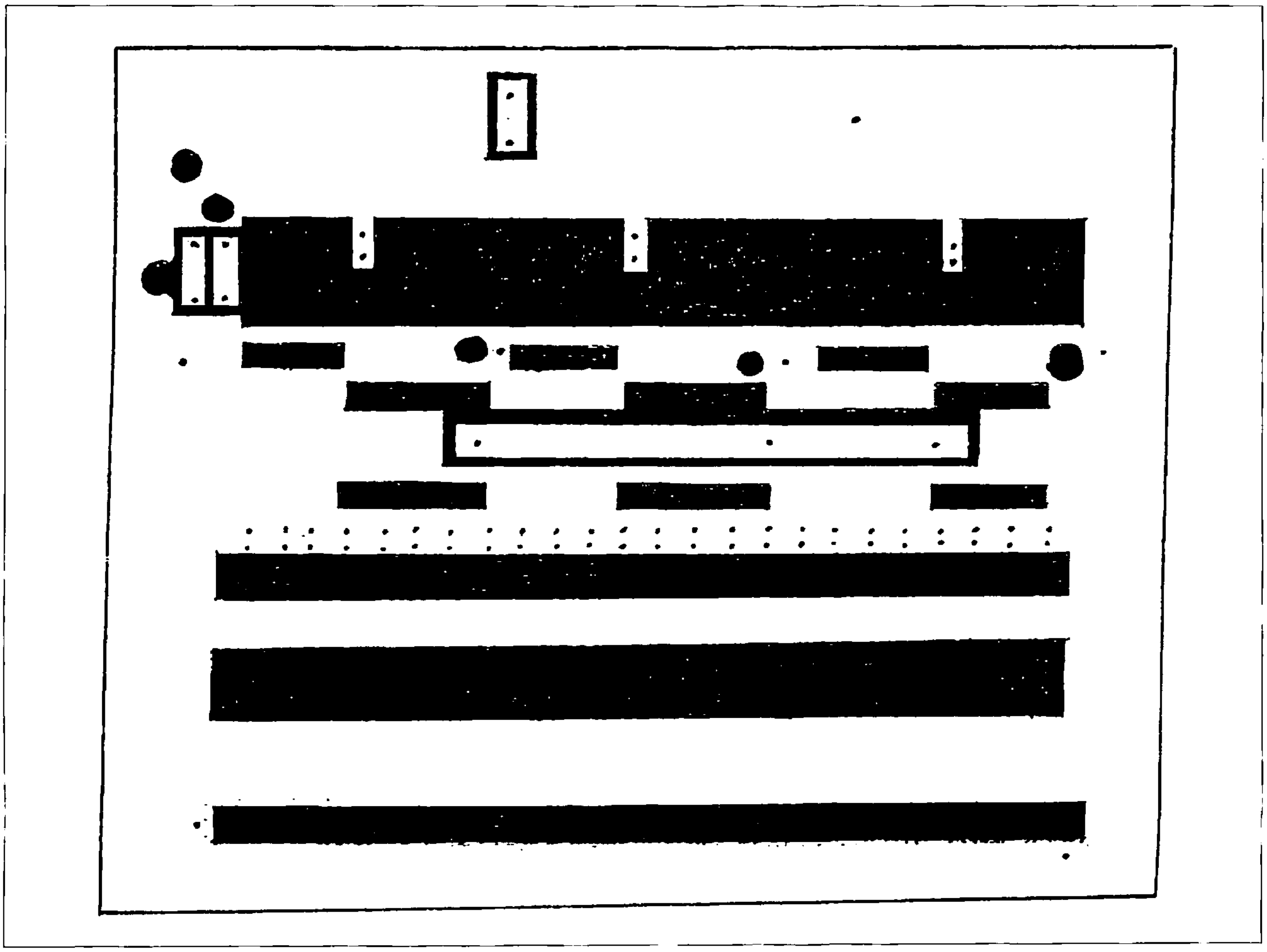

Fig. 2(b). Top trace view of the Data Receiver board.

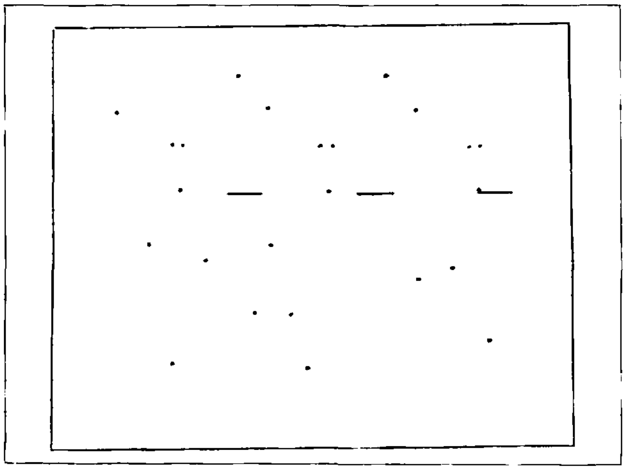

Fig. 3. Data Transmitter: Z-wire locations indicated by dots, and the lines show where wire jumpers are placed (shown at 50%).

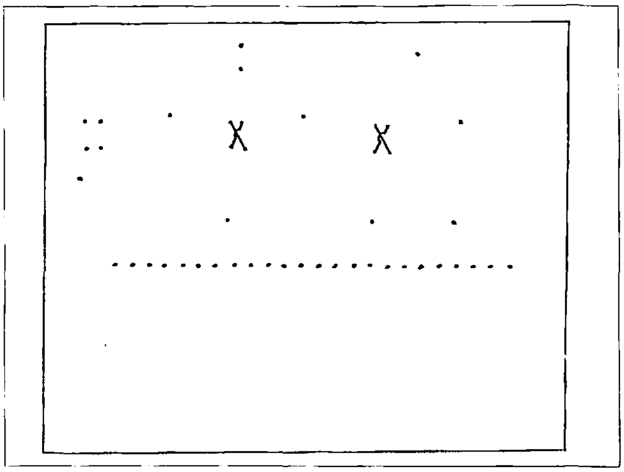

Fig. 4. Data Receiver: Z-wire locations indicated by dots. The lines show where wire jumpers are placed (shown at 50%).

and pressure can be determined before applying the dimpling operation to the circuit board. Dimpling means to "mark the copper," not "punch holes into it."

Using a sharp knife blade, cut the paper mask along the edge of the trace lines. Hold the knife at a very low angle so that the blade cuts the paper rather than pulls against the paper, bunching up the fibers as shown in **Photo D**. In tight areas, placing the blade edge on the trace line and then pressing it down hard is usually sufficient to cut the paper without the risk of pulling the fibers. When the rubber cement is firmly holding the paper, there is little risk of fiber pulling when a low blade angle is used while drawing the blade along the trace line.

During the paper cutting operation, it is important to remember that the knife is to cut the paper, not cut through the copper. Yes, the knife will

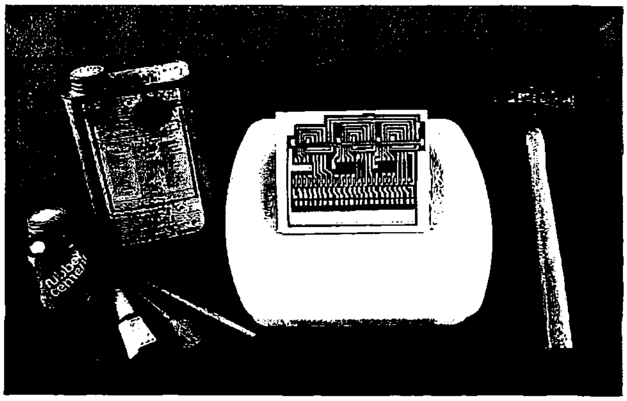

Photo A. The major items needed for circuit board processing.

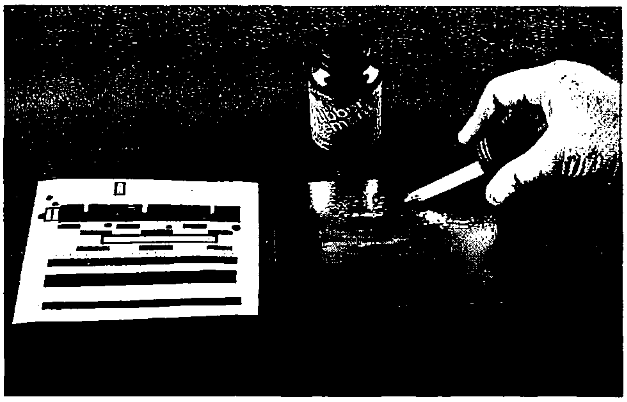

Photo B. The application of rubber cement to the copper surface.

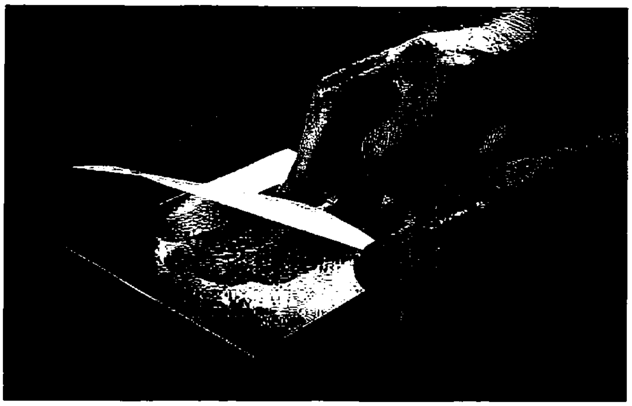

Photo C. *This shows how the paper mask is laid down onto the copper.*

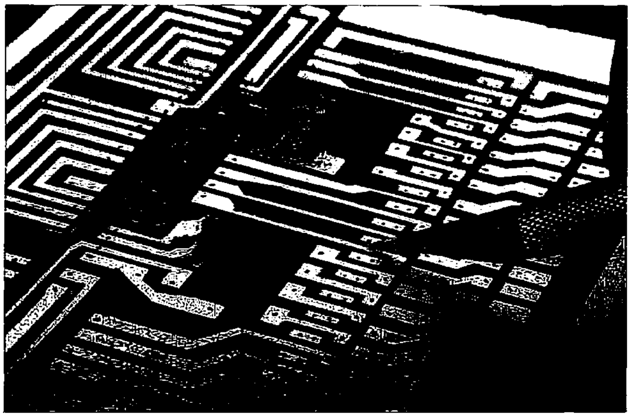

Photo D. *The circuit trace is cut with a shallow blade angle.*

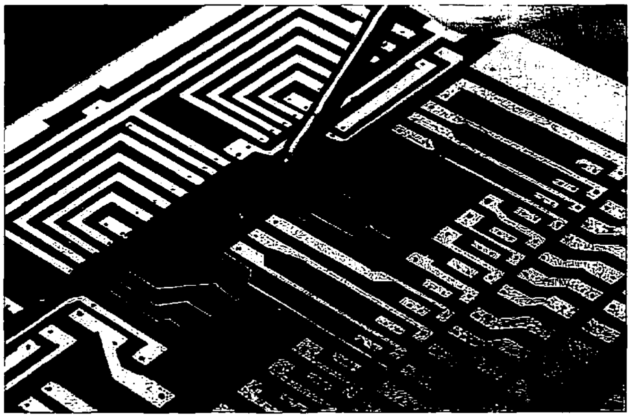

Photo E. *Fingernail polish is painted onto the copper through the paper mask.*

Photo F. *Fingernail polish covers all of the copper that is to be retained. The paper mask is being removed, exposing the copper to be etched away.*

Materials Needed for PC Board Processing

- Copy of the circuit trace pattern (actual size).
- Fingernail polish or lacquer paint (any color other than clear).
- X-acto knife or equivalent with a sharp blade.
- Rubber cement for paper use only.
- Printed circuit board material cut to size (single or double-sided, as required).
- Sharp scribe or pointed nail.
- Solvent (lacquer thinner, acetone, and/or alcohol).
- PC board drills #57 and #62, as needed.
- Copper etchant (ferric chloride or equivalent).

clearly mark the copper as it is drawn across the surface, but the intent is to cut the paper, not necessarily to cut into the copper. It takes a little practice to gain the right "feel" for the process to work smoothly.

When cutting a trace line, try to cut along the entire trace line without lifting the blade until you come back to the starting point. Lifting the blade and resuming the cutting operation may create a paper burr at the junction of the stop and start position. Should that occur, the knife blade should be pressed down against the burr to cut it completely.

After the trace has been cut completely, begin lifting out the paper piece representing the copper trace to be retained. Watch for any uncut paper fibers and sever them with the knife blade to free the paper trace as it is lifted. Inspect the exposed copper for any remaining rubber cement and remove any residual. The exposed copper is the trace pattern that is to be retained for the circuit.

Look for any cutting errors in the trace pattern, and if there are none, then brush some fingernail polish onto the exposed copper as shown in **Photo E**. Give the polish a few minutes to cure before working on adjacent trace patterns. Trace patterns away from the one just filled with polish may be

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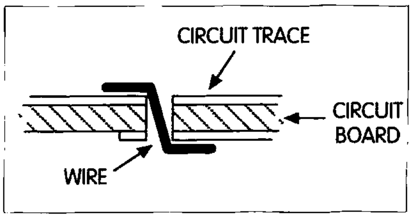

Fig. 5. *Details of using a Z-wire to connect together the top and bottom side circuit traces of the board.*

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Crystal Oven Controller

Build this solid state regulator for your oscillator oven assembly ... OK, it's not for everybody!

There are two main ways to keep the output frequency of a crystal oscillator stable; use a temperature sensor and feedback to correct the frequency, as with a TCXO, or operate the crystal in an oven set to the crystal's turning point. Of the two, the oven is the easiest for a radio amateur to implement.

Crystal ovens can be classed as one of two types according to the method used to regulate or control the temperature: thermostatic or proportional. Thermostatic ovens use a simple bi-metal–controlled set of contacts which open and close at the operating temperature, much the same as a common house furnace thermostat. Proportional ovens regulate the amount of heat generated until a balance is reached at the desired temperature.

Of the two types, proportional ovens are typically the more expensive and the more stable. However, thermostatic ovens are less expensive, and if there is significant insulation between the heater and the crystal, they can be as stable as proportional ovens. But, such well insulated ovens are typically larger than most popular ovens. The chief drawback to a thermostatic oven is the wear and tear on the thermostat contacts. This article presents my solution to the pitting and wear on the contacts of a particular crystal oven, but is applicable to most thermostatically controlled crystal ovens.

I had been looking for a good, inexpensive, precision frequency standard for doing some oddball astronomical timing and photography when I happened upon a module from a military surplus SRT-14A. What I had found was the RFO, Unit 1 (Z-2001), 100 kHz reference oscillator — see the photographs. This oscillator generates a very stable 100 kHz that it supplies to the various synthesizer modules. The oscillator module is compact as far as hollow-state boat anchor units go and uses a 5654 (6AK5) oscillator and two 5814 (12AU7) cathode follower output tubes. The output frequency is stable to better than one part per million over weeks and the aging of the crystal is very low if for no other reason than its age. Changes in crystal frequency attributable to aging decrease with the operational age of the crystal.

Originally, the module was operated from a regulated 250 VDC supply, but I found that it would work at voltages as low as 30 VDC. I opted to run mine from a regulated 150 VDC supply. The most prominent component, the oven, is a model TC922 made by Bliley Electric Company, measuring about 4.5 inches tall by 3.75 inches in diameter. It has a seven-pin base connector

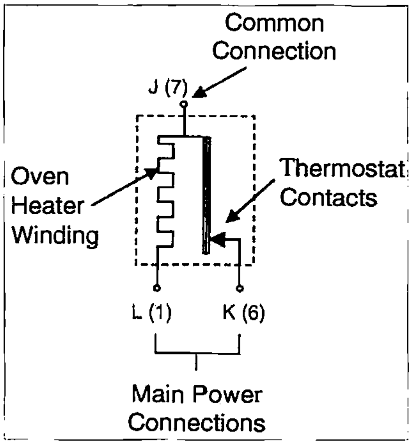


Fig. 1(a). Typical oven wiring.

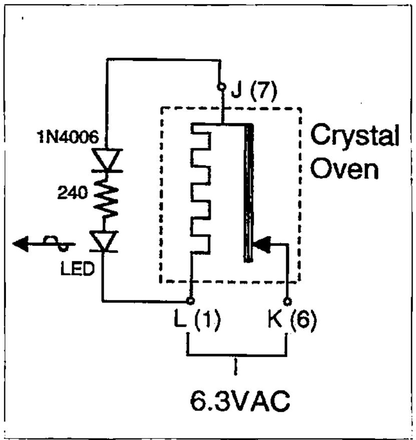


Fig. 1(b). Oven with LED indicator.

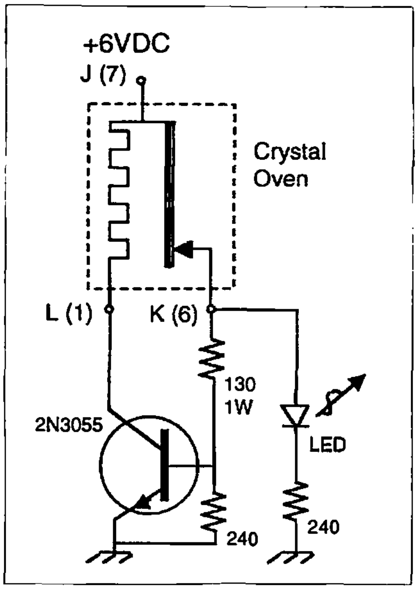


Fig. 2. Transistorized thermostat with LED indicator.

and is mechanically clamped in place. The oven was designed to operate at the upper temperature turning point of the 100 kHz crystal, 70° C. The TC922 oven was designed to draw a maximum power of ten watts, or 1.58 A at 6.3 VAC.

Actually, I eventually found two complete oscillator modules. But, the thermostat contacts in the second module oven were pitted and worn. Burnishing the contacts brought temporary relief, but it was soon obvious that the thermostat was beyond repair.

An E-mail to the Bliley Electric

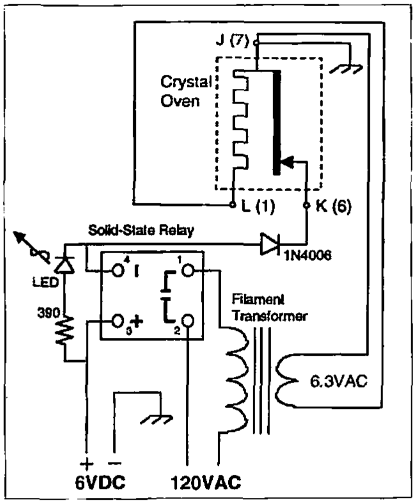


Fig. 3. Solid state relay thermostat controller with LED indicator.

Company confirmed my fears — they no longer stocked the original oven or replacement thermostats. Months later, at a hamfest, I found a matching oven complete with crystal. It was missing a large portion of the Bakelite upper cap, but the asking price was very reasonable. Combining parts, I now had a complete second oven and oscillator module. Not wanting to lose either of my working units to further contact pitting and wear, I needed to find a way to reduce the contact current.

I considered converting the ovens to full proportional control, but I did not want to change any of the module wiring (so that boat anchor fanatics/purists would not hunt me down). I did want to reduce the thermostat contact current to extend the life of units already over forty-five years old. Seriously, amateur radio operators, me included, have been too eager to tear into surplus equipment and make modifications rather than work with and use the original design. When someone examines a piece of surplus equipment at a hamfest and notes the presence of a new control or hole, the first word that comes to their mind is "butchered," not "enhanced." All modifications in this article are external to the original oscillator module.

Every thermostatically controlled oven I have run across connects the thermostat contacts in series with the resistive heater windings or element as shown in **Fig. 1(a)**. The small letters in the figure correspond to the SRT-14A oscillator module connector pins. The numbers in parentheses correspond to the oven pin numbers. Most, if not all, oven designs bring the common connection out to serve as a part of an indicator circuit for contact closure or oven cycling. The easy access to the common connection is what allowed me to treat the thermostat contacts and the oven heater windings separately.

First, I tested each oven by adding an LED with a rectifier diode and a current limiting resistor in parallel with the heater windings to indicate when the oven was heating [see **Fig. 1**(b)]. This works whether the oven is operated from DC or from the original AC.

Once I knew the two ovens were operational and cycled normally, I decided

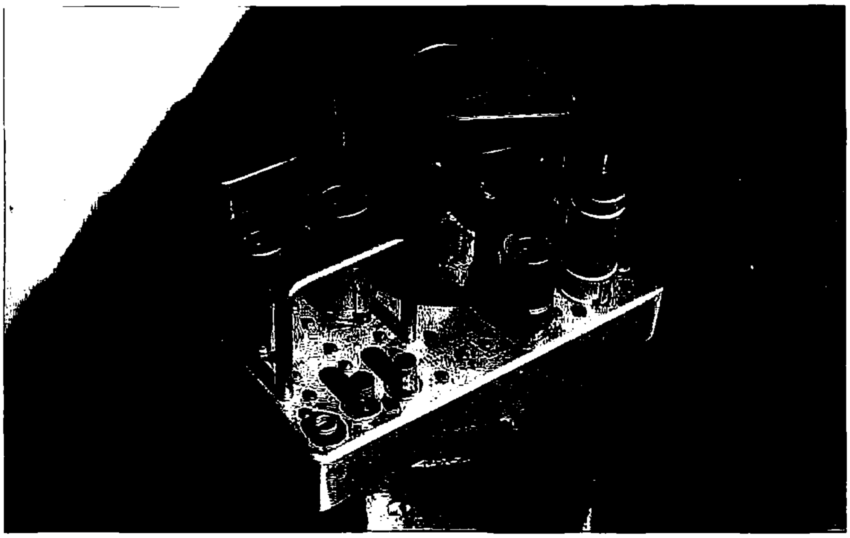


***Photo A.** View of the complete SRT-14 reference oscillator.*

to use a transistor to reduce the current through the oven thermostat contacts. I had already decided to operate the three vacuum tubes from a regulated 6 VDC filament power supply. This would extend the life of the tubes and remove any concerns about line voltage fluctuations. I used a simple 2N3055 circuit, complete with an LED oven heating indicator as shown in **Fig. 2**. The LED circuit is no longer connected across the oven heater windings but is instead connected to the thermostat.

The 2N3055 needed only a couple of square inches of heat sink, so a simple aluminum "L" mounting bracket worked very well. However, it seemed as if the oven would never cycle off. I believe the problem was that the voltage drop across the 2N3055 was too high and the supply voltage too low. For a constant heater resistance, the heating is proportional to the heater voltage squared — hence a small voltage drop has a magnified effect. This problem could have been overcome by increasing the oven supply voltage to compensate, requiring me to build another power supply just for the oven — something I did not want to tackle.

I decided to take a different approach. I borrowed a solid state relay to use in experiments with the SRT-14A oscillator oven. Solid state relays are remarkable devices. For AC loads, they behave the same as low voltage relays. The control and switching circuitry are very well isolated. The actual control is done by LEDs deep within the device. They can be thought of as optoisolators for AC circuits. I wanted to see if I could control the solid state relay using the oven thermostat contacts and the 6 VDC filament supply. I worked out a schematic for how it might be done (see **Fig. 3**). I already had a 6.3 VAC, 3 A filament transformer (Stancor model P-6466) that was more than adequate for the 10 W oven heater circuit.

I tested and characterized the control side of the solid state relay, an Opto-22 model 240-D10, over the full recommended control voltage range from 3 to 25 VDC. This particular solid state relay is rated for 10 A resistive loads and is certainly overkill, but it was available, easy to mount, physically compact, and has convenient screw terminal connections.

It turns out that the control side circuitry of the solid state relay could be modeled as a fixed 1.5 V drop (the internal LED) in series with a 1 k resistor. With a 6 VDC supply, the control current is only (6 – 1.5)/1 k = 4.5 mA. Allowing another 12 mA for the oven indicator LED, the oven thermostat contact current would only be 16.5 mA, versus 1.6 A under the original configuration (about a 100x reduction). Putting the LED indicator back in parallel with the oven heater windings would reduce the contact current to a mere 4.5 mA, but did not seem necessary.

I breadboarded the solid-state relay oven heater controller. It worked great the very first time! The 1N4006 diode serves no purpose except to prevent AC from accidentally entering the control circuitry side of the solid state relay during testing; it can be replaced with a wire.

By the way, it turns out that my line voltage is a bit on the high side of 120 VAC. The no-load output voltage from the filament transformer is 20 Vp-p or about 7.07 Vrms. The oven heater voltage waveform is a nice clean sine

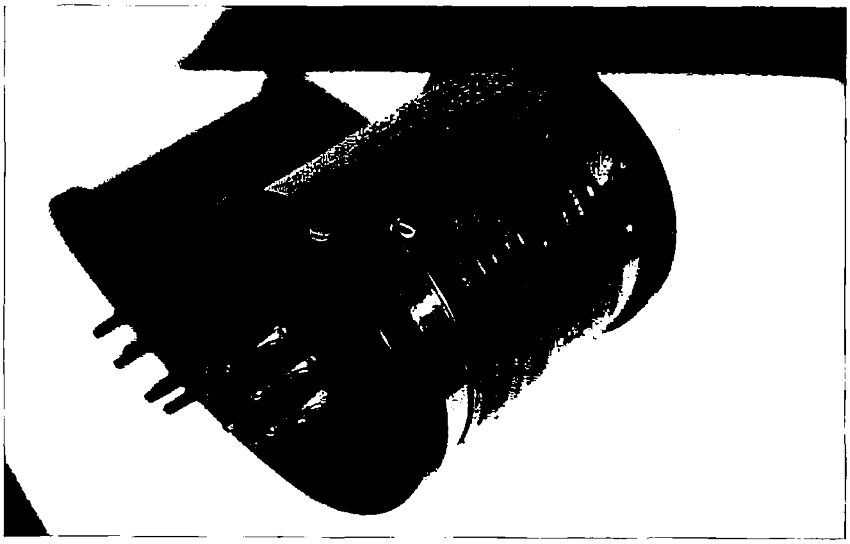


***Photo B.** Bliley crystal oven removed from SRT-14.*

Continued on page 59

Craig Kendrick Sellen
c/o Mallard Meadows RHC
476 Belmont St., Room 405
Waymart PA 18472

Need a Noise Blanker?

This impulse noise suppressor can be added to any SWL, ham, or CB receiver.

Automobile ignition and electrical impulse noise are serious problems for the ham station operator or SWL who lives near a busy street. Most commercial receivers have noise clipping provisions, but the circuit used is not effective for SSB or CW operation. Some receivers have no noise limiter of any kind. If your receiver is deficient in this respect and if you are bothered by ignition noise or other noise created by electrical impulses, this audio noise blanker is what you need.

The noise blanker works equally well with SSB, AM, and CW signals. It accepts a signal that is nearly indistinguishable because of impulse noise and makes it 90% readable. It is not necessary to modify your receiver; the noise blanker is connected between the low-impedance output of the receiver (3.2 to 16 ohms) speaker. The noise blanker itself requires no external power supply. An audio amplifier, which is used to raise the low level output of the blanker to a comfortable speaker level, does require a power supply. This will be explained later. Refer to **Fig. 4**.

Circuit operation

Refer to **Fig. 2**. Assume that a high level noise pulse, whose amplitude greatly exceeds the blanking level, enters the system. After passing through transformer T1, where it is split into two identical signals 180 degrees out of phase with each other, the signal takes two different paths, as shown in the diagram.

In the lower path, the signal (waveform A) passes through a peak clipper consisting of diodes D1 and D2, which are connected in opposite polarity and are in parallel with the signal path and ground. When the noise-pulse amplitude reaches the voltage level equal to the reverse bias on the diodes, both diodes conduct and shunt everything above this level to ground. The truncated signal (waveform B) is then passed to balance potentiometer R6. This type of circuit is called a peak clipper, and similar circuits are found in many receivers.

The other input signal, waveform C, is fed to a base clipper consisting of a pair of diodes, D3 and D4, connected in opposite polarity and in series with the signal path. The arrangement does not allow the signal to pass until its amplitude exceeds the blanking level. The portion of the signal that exceeds the level (waveform D) is passed to a peak clipper consisting of reverse-biased diodes D5 and D6 which are connected in opposite polarity between signal and ground. Operation is the same as in the D1, D2 peak clipper.

The two clipped output signals, waveforms B and E, are applied to opposite ends of balance potentiometer R6. If the wiper of this potentiometer is adjusted to receive signals of equal amplitude, the composite signal appearing as the audio output then looks like waveform F. Note that this signal contains far less power than the original input waveform, and even less power than a peak-clipped waveform.

The result is that, regardless of how great the noise is compared with the desired signal, any noise pulse that exceeds the blanking level will not only

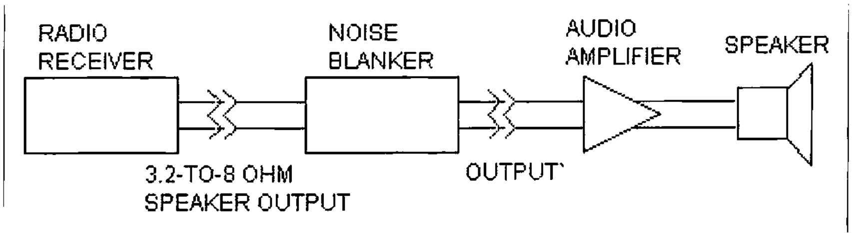


***Fig. 1.** The noise blanker connects between the receiver loudspeaker output and external audio amplifier.*

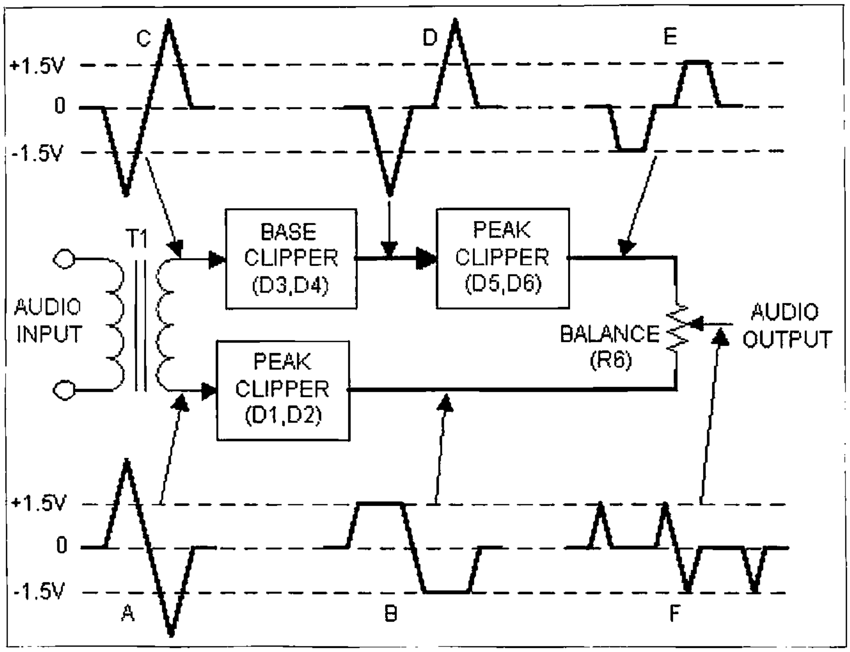


Fig. 2. Waveform diagram.

Part	Value	Description
B1–B4	1.5 V	AA penlight battery
C1	10 µF 15 V	Electrolytic capacitor
D1–D6	1N34A	Germanium signal diode
R1, R2	1.8k 1 W	Resistor
R3–R5	10k 1/4 W	Resistor
R6	50k	Miniature trimpot
S1	DPST	Switch
T1	50L6	Transformer (see text)
Misc.: Suitable perfboard, PCB, or other wiring method: battery holders, chassis box, solder, hookup wire, etc.		

Table 1. *Blanker parts list.*

be greatly reduced, but will in fact have an audio power less than that of the desired signal. Thus the noise can hardly be heard.

Construction

The circuit of the noise blanker is shown in **Fig. 3**. It is used in conjunction with **Fig. 4** and can be assembled on a printed circuit board, on perfboard, or with point-to-point wiring on tie strips. My version uses perfboard. The amplifier described here can work and any type of IC circuit can be used, such as LM380 or LM4862, etc. Remember, you must supply power for this audio amplifier. An LM386 was readily available and easy to use. Transformer T1 is a 50L6 audio output transformer, used because it was in my junk box — but any other type can be used if it has a low-impedance speaker winding and a 2000–5000 ohm primary winding. A good source for the transformer is Antique Electronic Supply, 6221 South Maple Ave., Tempe AZ 85285. Diodes D1 through D6 can be any general-purpose germanium signal units such as 1N34A. Be sure to observe the polarities on the diodes and, when soldering, use a heat sink on the leads.

Adjustment

The balance potentiometer R6 can be adjusted by ear, or for more exact results, with an oscilloscope. Connect the low impedance output of the receiver speaker to the blanker input (see **Fig. 1**). Turn on the receiver and the noise blanker and place noise blanker switch S1 in the OFF position. Set the receiver volume control to its normal position and turn the audio amplifier gain up so that you can hear a signal. Adjust the noise blanker amplifier gain R7 to a comfortable listening level and turn S1 ON. Turn up the receiver volume control until the speaker output is very distorted. Adjust the balance control R6 until the audio output is at a minimum. This will be close to the mid-position of R6. Once R6 is adjusted, it will remain correct for a long period of time unless components age or are replaced.

Part	Value	Description
C2	0.22 µF	Mylar capacitor
C3	10 µF 15 WVDC	Electrolytic capacitor
C4	0.047 µF	Disc capacitor
C5	220 µF 15 WVDC	Electrolytic capacitor
C6	100 µF 15 WVDC	Electrolytic capacitor
R7	50k	Panel-mount pot
R8	10 Ω 1/4 W	Resistor
ICI	LM386-N	Audio amp

Table 2. *Amplifier parts list.*

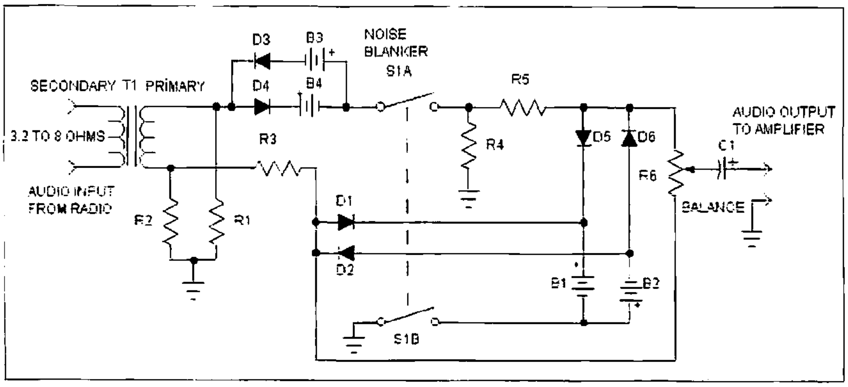


Fig 3. *The blanker circuit.*

Operation

Tune in a signal, set the audio amplifier gain for a comfortable listening level, and advance the receiver volume control until some audio distortion is noticed. At this point, back off the receiver volume control slightly until the audio is clear. This means that the noise blanker is operating properly; the receiver volume control is now the blanking-level control, and the audio output level is controlled by the gain control on the noise blanker amplifier.

When you tune in very weak or very strong signals, the receiver volume control may need to be readjusted, depending on the effectiveness of the receiver AGC system. If the receiver volume control is set too low, the noise blanker will not be as effective as desired; if the receiver audio control is too high, the desired audio will be distorted.

The noise blanker does not begin to work until the amplitude of the impulse noise is greater than that of the signal — it works best when the noise amplitude is several times that of the signal. Therefore, it is important that the noise pulse not be limited or suppressed by the receiver. In some cases, turning off the receiver AGC may improve the noise suppression characteristics of the system.

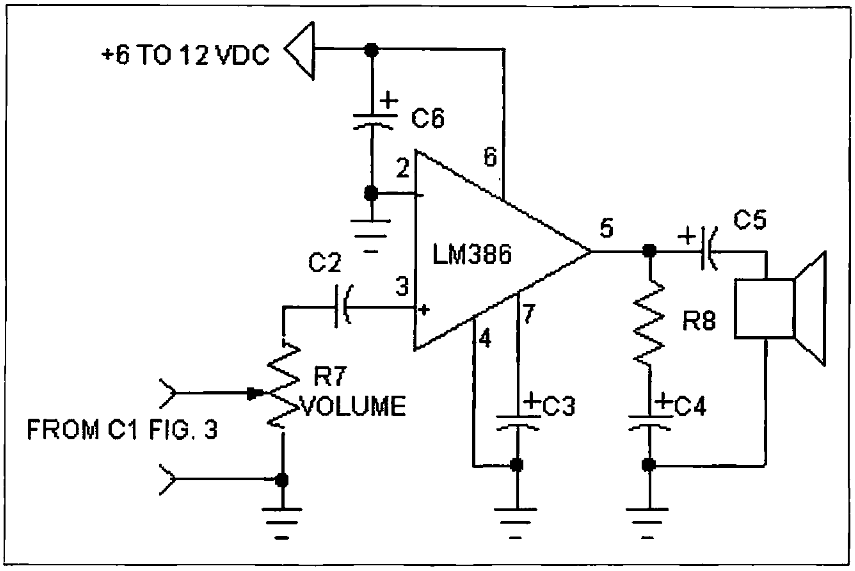


Fig. 4. The audio amplifier.

The noise blanker has been used very successfully with a mobile SW

Continued on page 61

Parker R. Cope W2GOM/7
8040 E. Tranquil Blvd.
Prescott Valley AZ 86314

Beginner's Battery Charger

A simple project to get you going.

This KISS (Keep It Stupidly Simple) battery charger can keep your rechargeable batteries fully charged, worry-free. The charger can recharge 1.2 volt NiCds, 12 volt lead acid batteries, or any rechargeable battery. The battery voltage isn't important. Just plug it in to keep your batteries charged and ready when you are. However, be aware that the charger can represent a shock hazard under some conditions and should be treated as a live 120 V wire. If it is plugged into a ground fault interrupter (GFI), you can't get stung.

How does a GFI protect you from a shock? If the hot side of the line is connected to the automobile's frame (the negative side of the battery) and the neutral line is open, the circuit is completed from the line to the car's frame and from frame to you and ground. Ouch! The GFI senses current in the earth (you) and disconnects the power.

The National Electric Code requires GFIs in the kitchen, the bathroom, the laundry, and garage, but not in other wiring branches in the building. The requirement for GFIs is relatively new, and some houses are wired without a green or "bonding wire." The bare wire in the non-metallic cable (Romex cable) is the bonding wire. It is the green wire in appliances and the green screw in the wiring receptacle. Metal wiring conduit can take the place of a bonding wire. The green wire carries current only in the case of a fault in the ground wire.

The (GFI) may already be in the house, or if the house was wired before the National Electric Code required GFIs, you may have to add one. When you install a GFI, connect the GFI wiring with black to black, white to white and green to earth ground. If your house is wired with only two wires, black and white, white is grounded by the electric company — if you trust the electrician that did your wiring. If you don't trust him or her, measure the voltage from wire to earth. It had better be zero, if not, corrective action is required; change the wiring in the receptacle. The black wire should go to the brass screw and white to the chrome screw. But, if the electrician swapped the lines somewhere, white may not be neutral.

If you plug into a properly wired GFI, you won't get stung when the ground wire is open and you become part of the circuit.

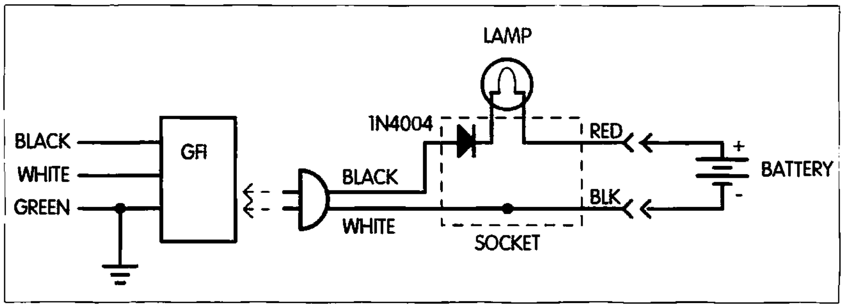


Fig. 1. A simple current-limited battery charger uses half-wave rectification.

The charger shown in **Fig. 1** is the utmost in simplicity. It can probably be built out of your junk box, but if your junk box is empty, the parts can be bought from your local hardware store and Radio Shack. The light bulb, socket, and plug are from the hardware store, and the rectifier diode and battery clips from Radio Shack. Of course, if you want to charge a "D"-size cell, then a battery holder will have to be used, but you won't need battery clips.

Any rectifier with a PIV greater than 200 V, such as 1N4004,5,6,7, can be used. The 1N4003 has a PIV of 200 V and costs maybe a dime less than the 400 volt 1N4004. The 1N4000 series of diodes has a 1 A current rating, and 1 A is the maximum charging current that the charger can supply. That's enough for most uses.

The peak inverse voltage on the diode is the peak line voltage plus battery voltage. Therefore, a 120 volt line (169 V peak) and a 12 V battery applies a PIV of 183 volts to the diode. A 12 volt lead acid battery has a voltage of 13.8 volts when charging. In the case of a fully charged battery, the PIV on the diode is 169 V+14 V = 183 V. Compare this to a half-wave rectifier operating from 120 volts with a capacitive input filter. The capacitor is charged to the peak, 169 V, and on the reverse half cycle the maximum voltage is the negative peak, so voltage across the diode is $2E_{pk}$.

The rectifier converts the 120 volt line current into half-wave rectified current, with the lamp limiting the current. The lamp can be anything up to 200 W. The higher the wattage, the higher the charging DC current. The diode can be put into the lamp socket with room to spare.

The resistance of the lamp limits the charging current and provides a constant charging current to the battery. The current in a lamp with half-wave current is not easy to calculate exactly, because an incandescent lamp has a very nonlinear resistance characteristic that is dependent on the current. But a first-cut estimate can be made that assumes a linear resistance vs. current.

The full-wave current in a lamp is I = P/E, where E is the rated voltage for the lamp and P is the watts. The average full-wave (DC) current calculates to be 0.9 x I_{RMS}. The half-wave current is half that, or $0.45I_{RMS}$. The measured currents for a number of bulbs are given in **Table 1**.

The resistance of a lamp with half-wave current is found to be lower than the first-cut estimate. The calculated half-wave current for a 200W bulb is 0.75 but the measured current is 1 A_{DC}. In any event a 200 W lamp will recharge a "dead" car battery in a day or so.

Ideally, a trickle charge just replaces the charge lost through the battery's internal self-discharge mechanism. Prudence says to provide a little more current than the minimum, but not enough to boil away the electrolyte. A 15 W night light is appropriate for trickle charging most lead acid car batteries, but a 40 W bulb is also sufficient.

While the batteries are assumed to be 12 V lead acid car batteries (SLI, Starting, Lighting, and Ignition, batteries), NiCds or any rechargeable battery can be charged when an appropriate lamp or resistor is used to limit the current. A resistor instead of the lamp is appropriate for small, low-amp-hour batteries like NiCds.

Most car batteries have an amp hour rating of about 60 Ah, motorcycle batteries about 15 Ah, and NiCds in the order of 450 mAh. The physical size of a lead acid battery is good indication of its amp hour capacity. The watts per cubic inch of lead acid batteries are very similar across all manufacturers.

The current required to charge the battery depends on its amp hour rating, not its cranking amps. A charging rate equal to the amp hour rating is a good fast charge rate, and a "hot shot" would be about five times that. Of course, the KISS charger can only provide 1 A. The trickle charge rate is 10% or less of the amp hour rate, but that depends on the condition of the battery and how it has been used or abused. I've found that a trickle charge of about 0.1% into a two-year-old battery in a garden tractor will maintain a full charge. That is 60 mA into a 60 Ah battery.

When fast charging a battery, care must be taken not to overcharge. The capacity after overcharging is actually less than maximum. Overcharging quickly shortens life, and can boil away the electrolyte. That's sure not good for the battery. In a word, overcharging a battery doesn't do it any good. In the days when a car's voltage regulator was essentially calibrated relays, overcharging was the primary

Lamp Watts	DC Current (A)
200	1
100	0.42
60	0.26
40	0.17
25	0.1
15	0.065

Table 1. Bulb currents.

cause for the relatively short battery lives. With today's electronic regulators, battery life can extend to ten years.

Since the charging current is the important item, finding the desired current-limiting resistor becomes critical. Calculating the fixed current-limiting resistance is more certain: The average (DC) half-wave current is:

$$I_{av} = 0.318 \times I_{pk} = 0.318 \times \sqrt{2} \times E / R$$

or $0.45 \times I_{RMS}$.

Therefore, a 12 kΩ 1/2W resistor instead of a 120 volt light bulb would be needed to provide a 4.5 mA trickle charge current for a 450 mAh NiCd, while a 15 W light bulb would supply about 60 mA to a car battery. A 15 W lamp will keep a trolling motor battery or garden tractor battery fully charged over the winter to be ready to go when spring comes around.

There is some merit to the conventional wisdom that says keep the battery off the garage floor. At least off a cold floor. The plastic case doesn't care where it sits. Some say that when the battery sits on the cold garage floor, the temperature difference between the floor and the top of the battery causes the electrolyte to circulate and speed up the self-discharge. I won't get into that argument. It makes sense to set the battery on a couple of pieces of two by four even in a warm shack. The boards will protect the floor and keep the battery and XYL happy.

A battery can be charged with either a voltage source or a current source. Charging from a voltage source requires close control of the voltage and usually some upper current limit control as well as sensing the condition of charge. With current charging the charging is slower but independent of battery voltage and is a better "set and forget" approach.

The KISS charger is essentially a current source with the charging current limited by the light bulb or a fixed resistor. The current is essentially the same whether the battery is fully charged or completely discharged.

A charging current equal to the amp-hour rating of the battery is a fast charge while a current of less than 10% of the amp-hour rating is considered a trickle charge. A trickle charger will probably recharge a discharged battery but it will take just short of forever. I've found a trickle current of 0.1% times the amp-hour rating to be adequate for a garden tractor battery.

A typical 60 Ah car battery can be charged with 60 A in a little over an hour, but that rate can seriously overcharge the battery if you forget it. A 6 A charge for 10 hours is safe enough, but it too can overcharge the battery if it's left on too long. 0.06 A (a 15 W lamp) can trickle charge the battery for months without problems. Essentially set it and forget it.

The efficiency of the charger is very low. An amp from a 120 volt line to put an amp into a 12V battery is really pretty poor efficiency, but that's the price paid for simplicity.

The measured charging current versus lamp wattage is given in **Table 1**.

These measured currents are for a completely dead, zero volts, battery and the actual resistance of the lamp not known with certainty. Nevertheless, it's better than a WAG. The currents can be extrapolated for other lamp wattages. For example, a 7 W lamp will have a current that is a little more than 0.11 times that of a 60 W lamp. Using lamps with the same bases makes it convenient to change the charging current. You can change from a 1 amp rate to a 60 mA rate just by changing the light bulb.

The modern "maintenance-free" batteries are really just "low maintenance" batteries. They still should be checked occasionally by prying off the covers to make sure the electrolyte covers the plates. Add distilled water to bring the electrolyte a quarter inch above the plates if required. It won't be a catastrophe if you have to add plain tap water, but it's not the best thing for the long battery life.

For the typical automotive lead acid battery, the charging voltage is a reasonable indication of the state of the battery's charge. A typical 12 volt lead acid car battery has a charging voltage of about 13.8 volts, while the voltage under a light load is 12 volts. The specific gravity is the usual measure of the state of charge of a battery, but with sealed batteries, that's a bit inconvenient. So the terminal voltages, with all of their uncertainties, are used to indicate the state of charge.

While the main thrust here is toward lead acid car batteries, NiCds or other rechargeables can be recharged equally well. Just keep in mind the lower current ratings of these small cells. For low charging current, even a 15 W lamp will probably produce too much current and the lamp will have to be replaced with a resistor. To check the maximum charging current for a particular resistance or lamp, connect a DC current meter in place of the battery, then plug the charger into the 120 V mains. The indicated current is the charging current.

A rundown car battery can be recharged over the weekend with a 200 W lamp limiting the current. It's worth mentioning that if you expect to need a little extra help on a cold morning, put the lamp under the hood near the battery to keep things warm for the next morning's start. But don't forget to take off the charger before you crank the engine. The fan belts can chew things up in a hurry, and probably blow the line fuse as well.

A word to the wise: the voltage at the battery clips is 120 volts while the battery is disconnected. Unplug the charger while you're making the connection.

A simple charger can keep your shack's auxiliary battery up to snuff without constant attention. The charging current has to be a little more than the average discharge current. It doesn't take much of a charger to keep a battery charged.

Listings are free of charge as space permits. Please send us your Calendar Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the April issue, we should receive it by February 28. Provide a clear, concise summary of the essential details about your Calendar Event.

FEB 4

LORAIN, OH Winterfest 2001 will be held at Gargus Hall, 1965 N. Ridge Rd., 8 a.m.–1 p.m. Talk-in on NOARS repeaters 146.700(-) and 444.800(+). Ample all indoor commercial space, reservations required. There will be a hamfest and pancake breakfast. Tickets are $5 each at the door, and include admission for one to the hamfest and the breakfast. 6 ft. tables are $10 each. All workers require an admission ticket. Setup for vendors begins at 6 a.m. This event is being sponsored by the Northern Ohio ARS. For info, contact *John Schaaf K8JWS at (216) 696-5709; or write NOARS via E-mail at [noars@qsl.net]; or snail mail to NOARS Winterfest, P.O. Box 432, Elyria OH 44036-0432.*

FEB 5

SUN CITY, AZ An Amateur Radio Equipment Auction will be conducted at 7 p.m. by the West Valley ARC at St. Clement of Rome Catholic Church Social Hall, 15800 Del Webb Blvd., Sun City AZ, (1/2 mi. S of Bell Rd.). Free admission. The club keeps 10% on equipment sales. Talk-in on 147.30(+). Contact *Ron K6OP, (623) 546-5710; E-mail [ronk6op@juno.com].*

FEB 9–11

ORLANDO, FL The Orlando Hamcation Show and ARRL North Florida Section Convention will be held Friday, February 9th, noon to 8 p.m.; Saturday, February 10th, 9 a.m. to 5 p.m.; and Sunday, February 11th, 9 a.m. to 3 p.m. The Orlando ARC will sponsor this event at the Central Florida Fairgrounds, Rt. 50 Colonial Dr., 3 miles west of I-4. Special features include Guest Speaker Ed Petzolt K1LNC, the 1999 ARRL International Humanitarian Award winner. Forums: DX, satellite demos, Phase 3D, PSK-31, APRS. 150 commercial booths, 400 swap tables, the largest tailgate in the southeast, and RV camping with elect. and water, $16 per night. VE exams, must register in advance; call *Gil Lineberry at (407) 843-4122.* Register for the Foxhunt by 4 p.m. at the info booth. Admission $7 in advance or $9 at the gate. Talk-in on 146.760. Check the Web site for up to date info, [www.oarc.org/hamcat.html]. Contact *Ken Christenson, 5548 C Cinderlane Pky., Orlando FL 32808; (407) 291-2465; or [af4zi@juno.com].*

FEB 18

FARMINGTON HILLS, MI The Livonia ARC will present its 31st Annual Swap 'n Shop on Sunday, Feb. 18th, 8 a.m.–12:30 p.m., at The William M. Costick Activities Center, 28600 Eleven Mile Road (between Middlebelt and Inkster Roads). Talk-in on 144.75/5.35. For info send 4x9 SASE c/o *Neil Coffin WA8GWL, Livonia ARC, P.O. Box 51532, Livonia MI 48151-5532; or call the club hotline at (734) 261-5486.* Visit the Web page at *[www.larc.mi.org]; or E-mail to [swap@larc.mi.org].*

FEB 24

HORSEHEADS, NY The Amateur Radio Assn. of the Southern Tier, of Elmira NY, will sponsor its 20th Annual Winterfest on Saturday, Feb. 24th, 8 a.m.–3 p.m., at the NYS National Guard Armory on Colonial Drive in Horseheads NY. Talk-in on 146.70(-), with 147.36(+) as a backup. Admission is $5 in advance, $6 at the door. Children 10 and under admitted free. VE exams start at 9 a.m. Dealers will feature new and used equipment for sale. For more info, send an E-mail message to the auto-responder at *[winterfest@arast org].* You can also visit the Web site at *[http://www.arast.org]* and click on the Winterfest link.

LA PORTE, IN The LPARC Cabin Fever Hamfest will be held Saturday, February 24th, at La Porte Civic Auditorium, 1001 Ridge St., La Porte IN, 7 a.m.–1 p.m. Chicago time. Admission $5, tables $10 ea. Talk-in on 146.52 and 146.61(-) PL 131.8. For info, contact *Neil Straub WZ9N, P.O. Box 30, La Porte IN 46352; tel. (219) 324-7525; E-mail [nstraub@niia.net].* Visit the Web page at *[www.geocities.com/k9jsi/].*

MILTON, VT The Radio Amateurs of Northern Vermont will sponsor the Northern Vermont Winter Hamfest and ARRL Vermont State Convention on Feb. 24th, 8 a.m.–1 p.m., at Milton High School, Route 7 in Milton, 5 miles north of I-89 Exit 17. Features include flea market, dealers, book sales, forums and demonstrations. VE exams will be given at 9 a.m. and 1 p.m. Commercial exams at 1 p.m. Admission is $3, free for under 18 years. Tables are free while they last. Call for large setups. Check the Web site for forum schedule and vendor setup info. Talk-in on 145.15 rptr., bulletins on 146.67. Contact *W1SJ at (802)*

879-6589; or E-mail [w1sj@arrl.net]. Web site at [http://www.ranv.together.com].

FEB 25

HICKSVILLE, NY The LIMARC Winterfest 2001 Electronics Hamfair and Flea Market will open at 9 a.m. for buyers, with doors opening at 8 a.m. for vendors. The event will be held at Levittown Hall, 201 Levittown Parkway, Hicksville NY. Tables are by advance reservation only; $20 if received by February 14th, $25 after. *Payable to LIMARC, P.O. Box 392, Levittown NY 11756.* Each reservation includes one 6 ft. table and admission for one person. General admission is $6, children under 12 admitted free if accompanied by a paying parent. For more info visit the LIMARC Web site at *[http://www.limarc.org]*, or call the 24 hour info line at *(516) 520-9311*. Talk-in is on the 146.850 rptr., PL 136.5.

CUYAHOGA FALLS, OH The Cuyahoga Falls ARC, Inc. will host their 47th Hamfest, Electronic and Computer Show on Sunday, Feb. 25th, 8 a.m.–2 p.m. at Emidio's Party Center, 48 E. Bath Rd., at the corner of State Road, in Cuyahoga Falls OH. North Coast Amateur Radio Inc., from North Tonawanda NY, will be featured at this event. Tickets are $4 in advance, $5 at the door. 8 ft. tables are $14 for the first table (includes one ticket). $10 for each additional table. Contact *Carl Hervol, Hamfest Chairman, 2292 Lake Center St., Uniontown OH 44685. Tel. (330) 497-7047; or E-mail [carlh@voyager.net].*

MARCH 10

SCOTTSDALE, AZ The Scottsdale ARC hamfest will be held starting at 6 a.m. at Scottsdale Community College, 101 North - Exit Chaparral Rd., 9000 E. Chaparral Rd, Scottsdale AZ. Parking $2. Tables $10. RV parking. VE exams. For more info, contact *Roger Cahoon KB7ZWI, 8501 E. Edward, Scottsdale AZ 85250. Tel. (480) 948-1824. Mobile (602) 725-7256; Fax (602) 943-7651. Send E-mail to [rgcahoon@msn.com].*

MARCH 18

MAUMEE, OH The 46th Annual Hamfest/ Computer Fair of the Toledo Mobile Radio Assn. will be held 8 a.m.–2 p.m. at the Lucas County Rec. Center, 2901 Key St., in Maumee. For details, send an SASE to *Paul Hanslik N8XDB, P.O. Box 273, Toledo OH 43697-0273. Tel. (419) 385-5056; Web page [www.tmrahamradio.org]*

MARCH 31

WATERFORD, CT The Radio Amateur Society of Norwich CT will hold their 31st Ham Radio Auction at the Waterford Senior Center on Rt. 85, starting at 10 a.m. Setup at 9 a.m. From Hartford, take Rt. 2 South to Rt. 11 to Rt 85 South. From the Shoreline, take Rt. 95 to Rt. 85 North. Talk-in on 146.730(-). Bring your gear to sell (10% commission to RASON). Free admission, free parking. Contact *Mark KE1IU at (860) 536-9633; or see the RASON Web page at [www.rason.org].*

SPECIAL EVENTS, ETC.

NOW THROUGH END OF FEB

SAN JOSE, CA Some members of "The Crystal Set Radio Club" [http://clubs.yahoo.com/clubs/thecrystalsetradioclub], a very active Yahoo! clubs on-line discussion group forum, are sponsoring a Crystal Radio Building Contest. This contest is now underway, and runs through February, 2001. The contest objective is to demonstrate innovation and craftsmanship in the design and construction of homemade crystal radios. The contest is open to everyone worldwide. There are two classes of entries, Master and General, and three categories of design: General, 100% Homebrew, and Free Style. A contest Web site has been set up where you can find the detailed rules and information at *[http://w3.one.net/~charlie/contest/]*. A distinguished panel of judges has been assembled to judge the contest entries. Short biographical sketches are posted at the contest site. Each judge has had extensive experience in several areas of vintage radio and crystal set design and construction. Prizes, which have been donated by various individuals, include an unbuilt MRL-2 Crystal Radio kit, and a pair of vintage headphones. A FAQ page linked with the Building Contest site should answer most questions that might come up. It is updated as new questions come in. Hard copy information is available for those who do not have Internet access, but who are interested in the contest. Send an SASE to: *Crystal Radio Building Contest, c/o Lawrence A. Pizzella WR6K, 856 Ironwood Drive, San Jose CA 95125-2814 USA.*

FEB 16–FEB 25

ST. SIMON ISLAND, GA The Third Annual International "Elmer Memorial" Crystal Radio DX Contest will take place from 1200 UTC on Friday 16 February 2001 to 1200 UTC on Sunday 25 February, 2001. Rules for this contest can be found at [http://www.thebest.net/wuggy/]. These contests have been coordinated to allow those who build a Crystal Radio to enter in the Building Contest, to use their creation in the DX contest and report on its performance in the DX contest. For those without Internet access, a hard copy of the rules for the DX contest can be obtained by sending an SASE to: *Crystal Radio DX Contest, c/o O. Pool WB4LFH, 216 Hermitage Way, St. Simon Island GA 31522 USA.* You can hear lots of DX on the Broadcast band with the right kind of Crystal Set, Antenna, Ground and Phones. During the first two contests 1000+ mile DX was routinely logged. These were not just the 50kW clear channel stations, but many 1kW and 5kW stations. Those who want to learn how to make a high performance Crystal Set, or are just curious about what is involved, are invited to visit *[http://clubs.yahoo.com/clubs/thecrystalsetradioclub]*, read the archived posts, look at the pictures of some crystal sets built by the members, and get to know this interesting group of "ultimate QRPers."

MARCH 17

MACON, GA The Macon ARC will operate W4BKM 1500–2200 UTC on Saturday, March 17th, at the 19th annual Cherry Blossom Festival In Macon. Phone 14.240, 21.335, and 28.390. For a certificate, send QSL and a 9 x 12 SASE to *Macon ARC, P.O. Box 4862, Macon GA 31208 USA.* 73

Andy MacAllister W5ACM
14714 Knights Way Drive
Houston TX 77083-5640

Aloft at Last

"It was a textbook launch, from the first minute of flight, until P3D separated from the Ariane 5 launch vehicle. All received telemetry indicates the launch went perfectly, and our satellite appears to be in very good health."

This was a quote from AMSAT-DL Executive Vice President and P3D Mission Director Peter Guelzow DB2OS, following the launch and deployment of Phase 3D on November 16, 2000, at 0107 UTC, from the European Spaceport in Kourou, French Guiana. It was later discovered that the 70cm transmitter did not come on as programmed, but signals were easy to receive and decode from the two-meter transmitter when it was activated.

P3D Becomes an OSCAR

It's been a long haul. The Phase 3D project began over 10 years ago. No one ever expected it would take so long or become so complex. It was worth the wait. The new name for AMSAT's largest and most advanced satellite is AMSAT-OSCAR-40. OSCAR stands for Orbiting Satellite Carrying Amateur Radio. The successful launch of this satellite that carries radio gear covering frequencies from 21 MHz through 21 GHz (or even higher if you include the onboard laser downlink) represents the beginning of a new era in amateur-radio communications. This is truly a "DC-to-light" hamsat.

The design life of AO-40 is 10 years. The satellite weighs about 1,400 pounds, 500 of which is propellant (monomethyl hydrazine, nitrogen tetroxide, and ammonia) to adjust the orbit. Phase 3D was mounted inside a conical adapter assembly that supported the main payload. The wingspan with solar panels unfurled will be about 20 feet. Stabilization is controlled by a unique 3-axis momentum-wheel system. Complete satellite details appeared in the October, 2000 Special Satellite Issue of *73*. You can also find frequency charts and other specifications via the AMSAT Web site: [http://www.amsat.org].

The Rocket

The Ariane-5 launcher is the latest and most massive rocket in use by Arianespace and the European Space Agency. The complete rocket stands about 150 feet and weighs just under 1.5 million pounds at lift off. The main engine is cryogenic, but the two strap-on solid rockets generate the majority of the thrust. However, they only burn about a fourth of the time during first-stage flight.

The upper stage engine is quite small by comparison, weighing only 21,800 pounds. It provides 100 seconds of powered flight before release of the main payload.

The Ariane-5 design goal is 98.6 percent reliability. The program uses proven avionics, redundant control systems, a cryogenic engine that is ignited and controlled prior to take-off, only four motors (two solid and two cryogenic), and a simplified system architecture.

The Other Passengers

Phase 3D was not the only passenger on Ariane flight V135. The main payload (mounted above P3D inside the payload fairing), weighing in at over 10,000 pounds, was PAS-1R from PanAmSat. It was built by Boeing Satellite Systems, Inc. as a long-life (15 years) replacement for PAS-1. The satellite, when fully deployed, has a wingspan of 134 feet, carries 36 Ku-band transponders and 36 C-band transponders, and

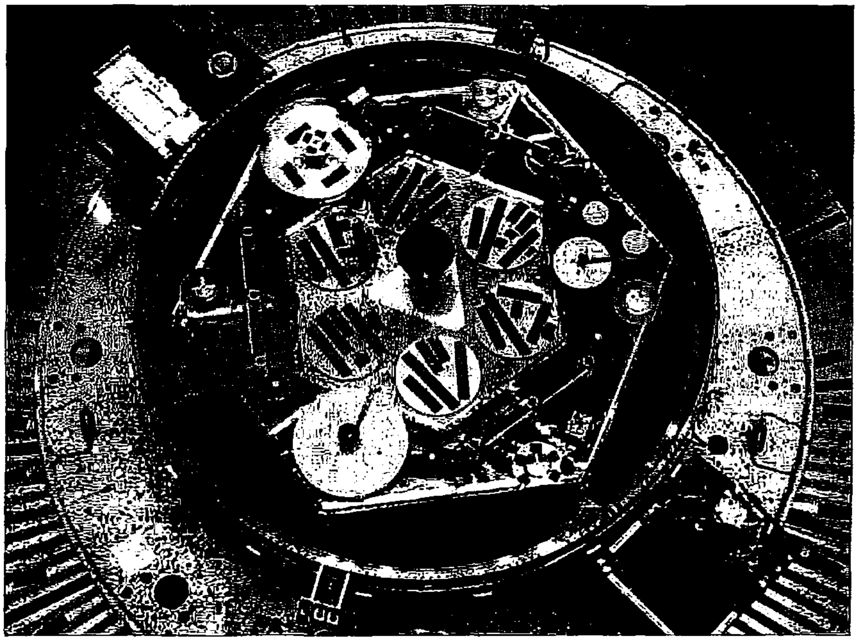


***Photo A.** A final look at Phase 3D (now AO-40) inside the conical adapter ring waiting for launch. (AMSAT-DL photo)*

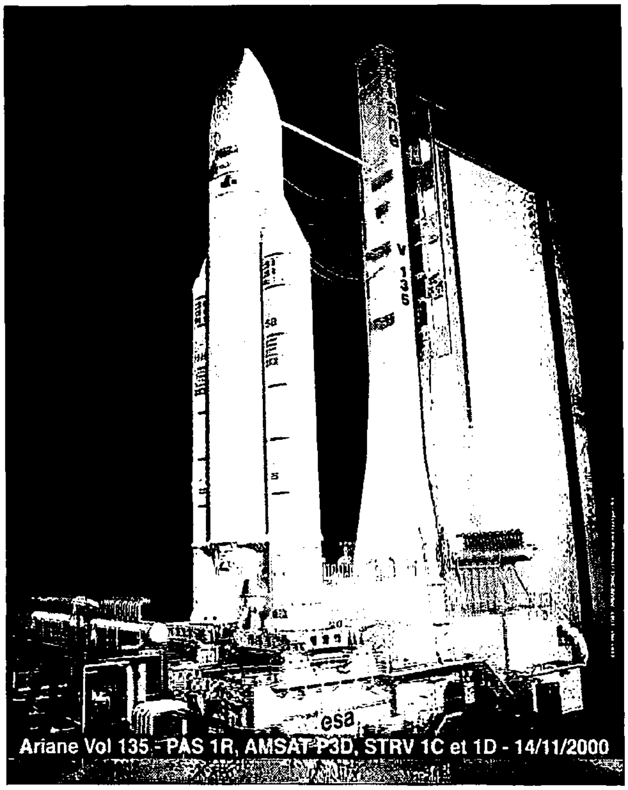


Photo B. The Ariane 5 launcher just before launch from Kourou, French Guiana. (Arianespace photo)

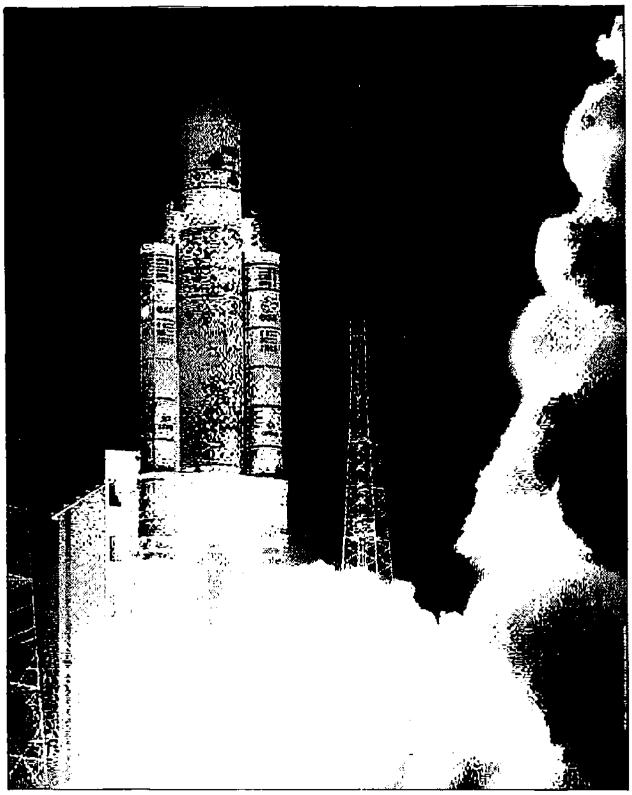


Photo C. Liftoff of Ariane mission V135 with AMSAT's newest satellite on November 16, 2000. (Arianespace photo)

has an onboard power of 15 kW. It is positioned at 45 degrees west above the north coast of Brazil in geostationary orbit. PAS-1R's coverage area includes Africa, the Americas, and Europe.

The other two passengers were relatively small (220 pounds each) British military micro satellites, STRV-1c and STRV-1d. They both carry research experiments for digital data communications and were attached to the ASAP (Ariane Structure for Auxiliary Payloads) ring at the base of the payload structure. These British satellites are cubes less than three feet on a side, have a design life of two years, and do not carry any propulsion systems to adjust their orbits. The ASAP ring is designed to carry several small satellites along with the main payload, but for this flight, there were only two.

The Flight

This was the seventh launch of an Ariane 5 vehicle. The first flight, just a few years ago, was a catastrophic failure, but since then the Ariane-5 program has progressed well. This flight carried nearly 14,000 pounds of payload to a geostationary transfer orbit. The perigee, or low point, was 590 km. The apogee, or high point, was 39,000 km, with an inclination to the equator of 6.5 degrees.

While the flight was originally scheduled for a day earlier, there was a communications problem that caused a 24-hour delay. AMSAT members and other hamsat enthusiasts took the wait stoically. What's one more day after years of anticipation?

Nine hours before launch, the final countdown began. All of the electrical systems were checked, the main cryogenic tanks were filled, and at T minus 6 minutes, 30 seconds, the synchronized sequence started. Six minutes later, the automated ignition sequence began. The countdown during the last 10 seconds was in French, but no translation was needed. The "count finale" proceeded to it's inevitable conclusion with the Ariane 5 rising majestically off the pad.

This was a nighttime launch. The sky above Kourou lit up like day as the massive launcher took off. Commentators at the site were awed by the scene and the accompanying sound and vibrations. Camera views of the take-off were shown from various angles and the jettisoning of the solid boosters was clearly visible at 2 minutes, 25 seconds, into the flight. The launch video was available to North America live via C-band satellite. It was on Galaxy 4R at 99 degrees west.

At 29 minutes, the main payload, PAS-1R, was released. Then, at 34 minutes, the

pair of micro satellites, STRV-1c and STRV-1d, separated from the ASAP ring. At 41 minutes into the flight, the ASAP was released. The Y.A.C.E. (Yet Another Camera Experiment) on Phase 3D recorded this event for later download. Finally, at nearly 42 minutes after launch, Phase 3D became an OSCAR. When telemetry indicated a successful separation of the newest hamsat, applause and relief filled the Jupiter control room in Kourou.

Here We Go!

During the last few years I have heard a lot of hams say that they would get into satellite work or join AMSAT when Phase 3D (now AO-40) was up. The wait is over. It's time to check out gear that has been lying around waiting for this day, or to investigate the new radios and antennas that will work with AO-40. It's also a good time to join AMSAT or renew your membership. You can check out the AMSAT Web site [http://www.amsat.org] or call Martha at (301) 589-6062.

It will be a while before AO-40 is fully commissioned. Orbital maneuvers using the main engine and the ammonia arcjet motor will take several months before the target orbit is achieved. The geostationary transfer orbit provided by the Ariane 5 does not provide the ground track and coverage that the satellite designers desire. Through the use of multiple main engine firings and two long periods of arcjet usage at one to two hours per orbit at perigee, the apogee will be raised to almost 48,000 km (30,000 miles), the perigee to 4,000 km (2,500 miles), and the inclination to 63 degrees with respect to the equator. All of these changes may take most of 2001 to complete. When they are done, the solar panels will be deployed and the high-power systems and transmitters can be activated.

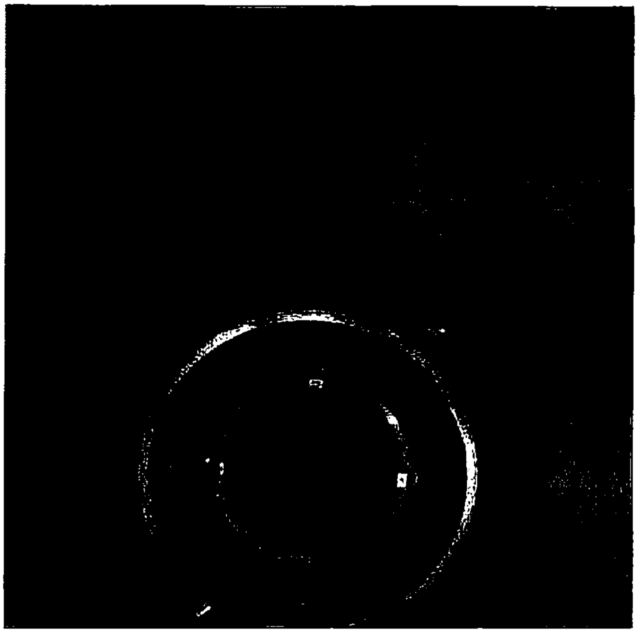


Photo D. *Y.A.C.E. image from AO-40 of the conical adapter ring separation just before deployment of our newest hamsat. (G3RUH and AMSAT-DL photo)*

In the meantime, there will be periods when the satellite will be made available for amateur-radio communications. This will give hams a chance to check out their ground stations and make some contacts via AO-40. It will also be a good time to learn more about telemetry and orbital mechanics. 2001 will be an exciting year!

Radio Direction Finding

Joe Moell P.E. KØOV
P. O. Box 2508
Fullerton CA 92837
[Homingin@aol.com]
[http://members.aol.com/homingin/]

Albuquerque Invites the World to Foxhunt

Last fall, I began researching sites for the first USA championships of international-style foxhunting, which is also called radio-orienteering, foxtailing, and ARDF. "Homing In" for October 2000 explained the requirements for hunt venues, accommodations, hospitality, and so forth. Response was excellent, many discussions were held, E-mails flew back and forth, and now the result can be announced.

The 2001 USA ARDF Championships will take place July 31st through August 4th in Albuquerque, New Mexico. They will be open to all ARDF enthusiasts, including visitors from any member country of the International Amateur Radio Union (IARU). The Albuquerque Amateur Radio Club (AARC) will host.

Headquarters will be on the campus of the University of New Mexico. That's where dorm rooms and cafeterias will house and feed the participants, and training sessions will take place. The formal competitions, one each on 2 meters and 80 meters, will be at nearby well-mapped sites in the beautiful Sandia Mountains.

The AARC, under President Mike Eaton K5MJE, is promoting all types of hidden transmitter hunts in central New Mexico, both on foot and in vehicles (**Photo A**). Chair of the Organizing Committee for the USA Championships is Jerry Boyd WB8WFK (**Photo B**). Readers of *73 Amateur Radio Today* will recognize Jerry as author of the 80-meter ARDF receiver project in the November 2000 issue.

Mike, Jerry, and the rest of AARC want participation from all over the USA and the world. They especially seek entries from Canada, Mexico, and other Western Hemisphere countries. If a team of ARDFers from any other North, Central, or South American country registers, the Albuquerque event could be designated as the Second IARU Region 2 ARDF Championships.

Photo A. Albuquerque, New Mexico, has had regular mobile hidden transmitter hunts like this one for about a decade. Now AARC members are adding on-foot hunts to their club activities.

The USA ARDF Championships are for anyone, with or without a ham license, at any ARDF skill level, beginner to expert. Competitors will be divided into appropriate age and gender divisions. Depending on the number of participants and their hometowns, there may also be some stateside geographical divisions to encourage friendly rivalries. Perhaps it will be North versus South, or East versus West.

Victoria Seeks Foxhunters, Too

There's another opportunity to display RDF excellence this coming August. The Seventh Friendship Radiosports Games (FRG-01) take place in Victoria, British Columbia, from August 7th through 10th. As described in this column many times (most recently in October 1999), the Games are a biennial tradition of Friendship Amateur Radio Society (FARS) chapters in USA, Canada, Japan, and Asiatic Russia. FRGs include CW sending, receiving, and pileup competitions, HF QSO contesting, and a two-meter on-foot foxhunt.

The four participating FARS countries will select their team members in coming months. You can apply for a position if you're an experienced radiosports fan living in one of them. Team sizes are limited. Contact Kevin Hunt WA7VTD of FARS-USA to apply for the USA's team, or Perry Creighton VA7PC of FARS-Victoria for the Canadian team. Electronic and postal addresses are under Resources below.

If you just can't get enough ARDF fun, it's possible to attend both these events. The time between them is just right for a scenic drive (and ferry) from Albuquerque to

Photo B. Jerry Boyd WB8WFK, who led the effort to bring the 2001 USA ARDF Championships to Albuquerque, enjoys designing and constructing his own RDF equipment. He built this dual-antenna RDF add-on unit several years ago.

Photo C. Three ARDF Team USA members, just back from the World Championships in China, were honored in Placentia, California, on October 28. Left to right, they are Marvin Johnston KE6HTS, Jay Thompson W6JAY, and Richard Thompson WA6NOL.

Victoria by way of Four Corners, Salt Lake City, Boise, and Seattle. With a little preplanning, you could have time to stop and see Canyon De Chelley National Monument, Natural Bridges National Monument, and Capitol Reef National Park. Maybe we'll have a mobile convoy!

Even if there's snow on the ground where you are right now, it's not too early to start making plans for your Y2K+1 ARDF adventures. Get your portable direction-finding gear built and tested so you'll be ready to start training when the weather warms up. Details and registration information for both events are available by mail and on the Web, as listed in Resources. You'll also find links and updates for these and other upcoming ARDF adventures at the "Homing In" Web site.

Feed 'Em and Fox 'Em

I can tell that interest in ARDF is growing by the increasing number of letters and E-mails asking about local events. Our "world class" radio-orienteers are scattered throughout the country, so they often have to travel long distances to attend events and get experience. Almost all of them are working to develop local interest in the sport, if for no other reason than to give them more practice opportunities. They are excellent teachers and are eager to help new foxtailers learn the rules, choose their equipment, and develop their technique.

Of particular note are efforts of Marvin Johnston KE6HTS in Santa Barbara, Bob Frey WA6EZV and Dick Arnett WB4SUV in Cincinnati, Sam Smith N4MAP in Atlanta, and Jerry Boyd WB8WFK in Albuquerque. They each put on several training events in the past year. Dale Hunt WB6BYU of Portland (OR), Charles Scharlau NZ0I in the North Carolina Piedmont, and others are stepping up their efforts.

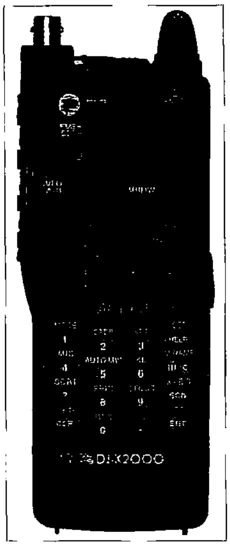
If you are close to any of them, get involved! If not, the task of developing ARDF locally is yours. With the help of other hams in your town, it can be relatively easy and fun. This may be just the activity to shake the doldrums out of your club. Start planning now!

An excellent way to increase the interest and participation in radio-orienteering is to make it a social event. That's how the SuperSystem UHF repeater network of southern California welcomed two of its members home from the ARDF World Championships in China last October. They fired up the grill at Tri-City Park in Placentia for a cookout of hamburgers, hot dogs, and Korean barbecued ribs, followed by a bevy of desserts that included the official Welcome Home cake (**Photo C**).

Then it was time to hunt transmitters.

Continued on page 50

New Products



Alinco Announces New DJ-X2000 Hand-Held Wide-Range Scanning Receiver

Alinco USA has announced the release of the DJ-X2000, a "new generation" wide-range receiver expected to be available in the North American marketplace this month. With continuous coverage from 100 kHz to 2150 MHz (cellular band excluded), the DJ-X2000 offers a broad package of functions and features not found in other scanning receivers. The new unit receives most common modes, including CW (Morse Code), wide FM, narrow FM, AM, upper sideband, lower sideband, and FM stereo broadcasts.

"Alinco designed this receiver to meet the needs of the listening enthusiast and for professionals in public safety and news gathering operations," said Katsumi Nakata KE6RD, Branch Manager for Alinco USA. "With 2000 memories, on-board 'help' navigator, hidden transmitter detection, and more, we are confident in saying there is nothing quite like it in the marketplace. It is such a fresh design, we have applied for two patents on new circuits included in this unit."

The DJ-X2000 features alphanumeric channel naming, is computer programmable, receives FM stereo broadcasts, has an instant "Flash Tune™" feature that can lock onto nearby signals, a frequency counter for checking radios in the field, and a digital recorder that can record a user voice memo or received audio for over two minutes. The receiver can also decode CTCSS tones commonly used by FM transmitters and can associate a tone associated with a given memory channel.

A Ni-Cd battery (EBP-37N) and quick charger (EDC-88) are included, and the receiver accepts battery packs used in several other Alinco radios. In addition, it can be powered by 12 V external DC, found in base or mobile operations.

Some technical highlights include a Digital Temperature-Compensated Crystal Oscillator (DTCXO) for frequency stability that is accurate to 1 ppm and technically superior to older TCXO designs. The dot matrix LCD display conveys an amazing amount of information, depending on the function the user has selected. From the relative field strength meter to graphic displays of band activity, it keeps the operator informed of its operations. The on-board "Help" navigator guides the user through most functions and features and can instantly instruct the user to change settings for the function in question. A new antenna design boasts increased sensitivity, improved low-end performance and a conventional BNC antenna terminal that allows easy connection to external antenna systems. A two-level attenuator reduces strong or interfering signals 6 or 20 dB.

Alinco expects a strong demand for the DJ-X2000, saying it may take some time for production to catch up with demand. The DJ-X2000 is the latest wide-coverage receiver to come from Alinco, which manufactures other receivers and a wide variety of transceivers for the amateur radio marketplace in North America. MSRP for the DJ-X2000 is expected to be US $650, but dealers frequently discount from manufacturer's price guides.

For further information, contact Alinco USA, 438 Amapola Ave., Ste. 130, Torrance CA 90501; tel. (310) 618-8616; fax (310) 618-8758; site [www.alinco.com].

Hamcalc Software

Hamcalc version 48, released last November, has many new programs and upgrades of existing ones. Over 250 painless math and design programs for radio amateurs and professionals, used worldwide as a design, reference, and learning tool since its introduction in 1993. Most programs can be run in either metric or imperial/US units of measure. Contains much information not readily found in current amateur handbooks and literature, but easy to use even for nontechnical hobbyists.

For a free Hamcalc CD-ROM, please send US $7.00 in check or money order (no stamps or IRCs, please), to cover cost of materials and airmail to anywhere in the world, to George Murphy VE3ERP, 77 McKenzie St., Orillia ON L3V 6A6, Canada. E-mail: [ve3erp@encode.com].

Mini-News from MFJ

• MFJ heavy-duty conventional regulated power supplies are super clean — no RF hash! Excellent for HF or 2m, 440 MHz transceivers and accessories. The MFJ-4322 delivers 22A surge and 20A continuous at 13.8 VDC. Its massive transformer, heat sink, and heavy-duty construction add up to over 19 lbs., and measure 8Wx4-3/4Hx11-3/4D inches.

• The MFJ-4312 delivers 12A surge and 10A continuous at 13.8 VDC, and weighs over 13-1/2 lbs. 8Wx4-3/4Hx10-1/4D inches. Like the 4322, it is highly regulated, with load regulation better than 1.5%. Extremely low ripple voltage — less than 40 mV.

• MFJ's 1717PL Back-of-Radio Antenna plugs into your 2m/440 MHz mobile or base rig in the shack. Fold antenna vertically, and you're ready to operate — no more coax tangles, finding a place to put a magnet mount, or putting up an outside antenna. This is a foldover dual-band flexi-duck with a quality PL-259 connector. 16-1/2 inches long. 2.15 dBi gain on 440 MHz; full-size quarter wave on 2m. Factory-tuned for minimum SWR. $24.95.

For further information, please contact MFJ Enterprises, Inc., PO Box 494, Mississippi State MS 39762; tel. (800) 647-1800; fax (662) 323-6551; E-mail [mfj@mfjenterprises.com]; site [www.mfjenterprises.com].

Photo D. Ryan Millard had his dad (Bob KE6JI) teach him to use RDF gear as they found the six easy two-meter transmitters at Tri-City Park. Then Ryan went out by himself to find the hard ones. Is he a future ARDF champion?

HOMING IN

continued from page 47

David Corsiglia WA6TWF and John Luthy KF6QCQ of the SuperSystem took groups of people out into the park to learn how to hunt three 440 MHz foxes. On 2 meters, I had a total of 11 transmitters to be found. Six of them were in easy-to-spot ammunition cans on separate frequencies for beginners. Each was on the air for about 7 seconds, then off for 30 seconds, then on again, and so forth.

For the would-be experts, I had an undisclosed number of micro-T's. (There were five, but they didn't know that for sure.) All were QRMing each other on 146.565 MHz, the southern California T-hunt frequency. One transmitter was in the rafters of a gazebo with its antenna in the clear. It was intended to jam the others, which were under the bleachers of the ball field, buried under some ivy, and so forth (**Photo D**). Who would find them all in the shortest time?

For those that finished that task quickly, a hidden 80-meter transmitter awaited, with hunting gear to find it available for loan. You may not be ready for such an elaborate event right away, but don't let that stop you from adding a simple transmitter hunt to a springtime cookout for your ham club. Maybe you'll discover a future ARDF champion!

How to Divide?

Even if you're too young to drive (or too old), you can participate in on-foot foxhunting. Team USA members competing in China last year ranged in age from 15 to 59. As in most long-distance events (such as 5k and 10k runs), there are IARU ARDF age and gender divisions at formal ARDF events so that teenagers aren't competing directly against senior citizens.

When foxhunting championships began in Europe about 20 years ago, the age range of competitors was rather narrow. Juniors were boys under 19 and Seniors were men 19 and up. As competitors aged and more older hams joined in, a division for Old-Timers (males 40 and up) was added.

In 1996, as the average age of foxtailers continued to increase, the Europeans added a separate division for males 55 and up, called Veterans. All this time, there has been only one division for females, regardless of age. That's hardly fair when you consider that the only woman on Team USA 2000 in China would have been a Veteran if she had been male. She was up against all ages in her gender division.

To date, formal ARDF events here in IARU Region 2 (North and South America) have usually followed the European/Asian age/gender categories. For next year's USA (and possibly IARU regional) Championships, it's time to decide if that will continue, or if we should go our own way.

In 1997, a committee was formed in Europe to propose revisions to the IARU ARDF rules. Of all the topics being debated, the one of most interest to us in the Western Hemisphere has been realignment of the age/gender divisions. The latest proposal (Version 2.4b, issued last August) calls for five male divisions and four female divisions. Age breaks for men would be at 19, 40, 50, and 60. For women, the dividing ages would be 19, 35, and 50.

As in the present rules, a person of any age could choose to compete in the prime-age division (19–35 for women, 19–40 for men), where they are required to search for all five hidden transmitters. All other divisions must search for four of the five, except for the highest age division (women over 50, men over 60), which would search for only three in this proposal. They can't choose for themselves which three or four to find, as that is determined and announced ahead of time for each division.

The new European rules are still undergoing some fine-tuning. Some parts, such as improved starting procedures for very large events, are already being tested. They are expected to be finalized in about eight months, then approved by the IARU Region 1 General Conference in 2002.

Should we adopt these new divisions here in Region 2? Or should we consider a similar plan that would leave male age divisions

Continued on page 61

Photo E. At local radio-orienteering events like this one in Thousand Oaks, California, foxtailers of all ages can compete for the same prizes. For regional, national, and world championships, age and gender divisions are essential.

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SSTV 2001

You don't need to spend a lot of money to have fun with pictures. Not anymore, anyway. With the advent of so many soundcard programs, many hams already have the setup in place to get right into SSTV and have a ball.

You will find it is really easy and the cash outlay can be minimal or none depending on your approach. Ideally, we would all like to have a digital camera to put images into our computer as soon as we snap a great shot. And many folks do. I haven't arrived there yet and life is still good in the image-on-disk arena. I do have a scanner, but they are reasonable these days if you want to go that way.

If you wish, there are other avenues. Most folks in the digital radio mode have Internet access. There are many great opportunities to lift excellent images from there. In any event, you will want a method of editing your images. In my case, I find it necessary to do a little tweaking with a low cost graphics program after scanning. I am using Paint Shop Pro 6. The price tag on that was about $100 and it does most anything I need. I am not a stickler for perfection and cannot justify the high end programs that cost 5 or 6 times as much.

So, what am I saying? If you are set up to do, for instance, PSK31 and want to get a few image files together on disk so you will have something to send over the air, you can get into Slow Scan Television for a trial run with a free demo download and a little learning time (usually very little, it is easy and the programs are intuitive).

I did this a few years ago and then got caught up in all these other digital programs and set the SSTV on the back burner. I decided it was time to revisit this area and I am glad I did.

Here is what I did to get going. I checked into the ChromaPIX Web site (**Table 1**) and downloaded the latest version of the SSTV software. I also downloaded and printed the manual, which is in Adobe Acrobat format. There is a real advantage to that format. First the software to open and print the file is free and secondly, the illustrations come out just like the day they were recorded.

The manual is about 30 pages and very informative with many screenshots and explanations of every button and control you will see on your monitor. I wouldn't tackle this project without that kind of assistance.

To make matters even simpler, the installation was a snap. I had an earlier version of ChromaPIX on the hard drive and the instructions were to remove that one which I dutifully did. The installation then progressed without a hitch.

I had brought up the old program a week or so ago and was not able to make a recognizable copy of any SSTV signals, so I thought I was going to have to do some adjusting with the new software before I could get started. There are plenty of instructions should this be necessary, and I wasn't terribly concerned.

So, as it happened there was no tweaking necessary. I tuned in the popular 14.230 MHz and waited a short time to hear an image being transmitted, clicked receive on the monitor, and — Presto! — there came an image that was perfectly defined. Well, except for the small problems caused by interference that crops up often in a 1,000-mile path.

I was pleased. The copy on the monitor was acceptable in keeping with the noise I could hear on frequency. Next, it was time to assemble a few images in a file. You will find most hams who work with SSTV have a huge file of digital images. I haven't "arrived" at the time of this writing.

I started with a scanned image that I put a few words into just for fun. Then I got a little antsy to get going and lifted a couple of colorful images from news sources I came across on the Internet. These weren't exactly entertaining, but gave a simple basis for some testing ground.

The next process was to gain some attention via SSB so someone would be ready to receive. First chance I had in midafternoon, the path from here to where the activity was, wasn't doing me much of a job. No one responded for about the first hour to my break-in calls. I was beginning to feel doomed or neglected, at least.

Suddenly a louder signal popped up that was a bit closer and we exchanged a few images. I got to watching the meters as the images were transmitting and realized I was transmitting the pictures at slightly below 25 watts.

That would explain some of the poor copy on the other end. The reason for the problem was easy to explain. I had been using relatively low power on the other digital modes and the soundcard driver was adjusted for decent performance with PSK31.

While the second image was on its way out the coax, I brought up the Windows control panel and boosted the drive. The response at the other end told me I was doing right. The meter showed the transmitted signal was now 50 watts. Much better.

I was now receiving reports that the images were just about perfect at the other end. Some of the improvement wasn't strictly power. As it happened, at least one of the stations I had barely copied from across the continent an hour or so previously came on, and the reception was now excellent.

There are a few other tricks that are necessary when working digital modes. One of the major concerns is that when the PTT automatically opens the mic circuit when you are ready to transmit, most transceivers broadcast every noise in your shack, via the mic input, along with the modulated SSB signal. It gets confusing at the receiving end, among other complications.

It is fairly easy to overcome this problem when using one of the PSK31 programs or

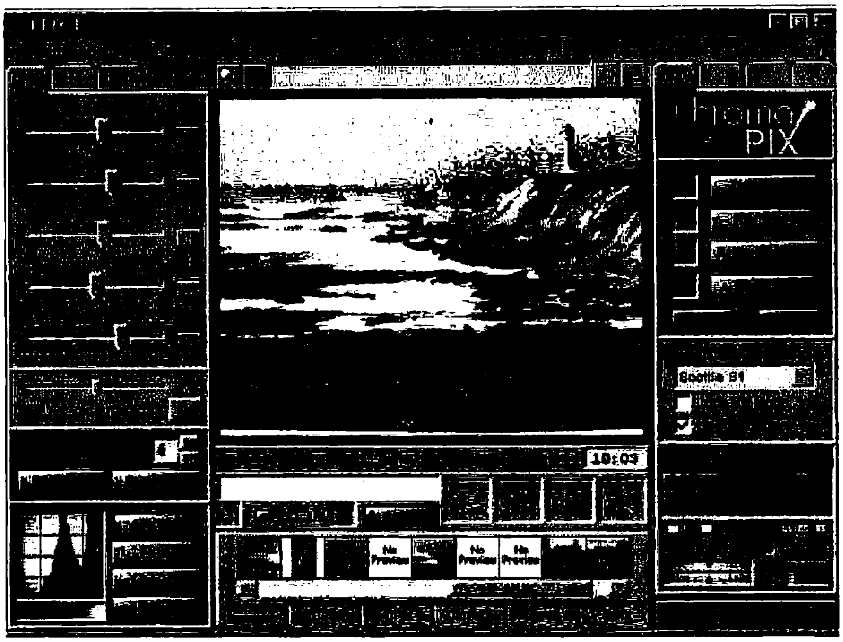

Fig. 1. ChromaPIX screenshot — This is what you see on your monitor. This was an off-the-air shot. The image is one I scanned in using the CSCAN module that comes with the package. I scanned using the option "clipboard." Then pasted to my graphics program and separated the several pics from the album page, then to the image file to be brought up as you see here. On the left are some slider adjusters which I tweaked a little to get the best resolution before this screenshot. The lighthouse in the upper right is still a bit hazy, but that may have been so in real life. The tabs above the sliders open other editing options. At the bottom left is a histogram for the image-keepers who are "pure-in-heart." Directly below the image are options for arranging borders and shading and inserting insets in the image. Below these controls is a well thought out file management system. The right panel is for controlling the interface with the radio, mode selection and tuning indicators. For a full description of all you see here, go to the Web site and download the manual. Won't cost you a dime to give it a look-see. Plus the full-working program can be downloaded for free while you are there. It will run for 30-minute intervals without registration. See The Chart for the URL.

MMTTY or any of the other great digital communications programs, because all that is really necessary is to unplug your microphone. What it can't hear, it can't send. However, with the SSTV mode, you will need the microphone in between sending images so you can communicate with the other stations.

Fortunately, my new Icom rig was designed to eliminate the problem. It has a SSB digital option that can be chosen from the front panel. It is quick and sure, just hold down the SSB button for two seconds and the mic is dead even with the accessory port PTT actuated.

There are other options available for the average rig. A simple solution is to cut the mic feedline and install a switch. I have talked to folks who are using this method. It works every bit as well as the push-button on the Icom.

There are other easy fixes. I believe several of the store-bought interfaces provide a switch in the box that allows the same function. All it took was a few thousand hams with the same complaint and along came the answers. Most likely other late model rigs are coming with a similar option and I am just not aware of it. As a matter of fact, I wouldn't have realized it was available on the Icom except in reading some aftermarket material. The info is probably cleverly hidden in the owner's manual and I missed it.

I can't criticize documentation too much. I was just recalling how I read the ChromaPIX manual and saw so many useful sounding features then quickly forgot them. I am now discovering them all anew and thinking, "Where did I read about that?"

You will probably do the same thing. This software is filled to the brim with bells and whistles. One that comes to mind is clicking — or is it double-clicking? — on the image and it automatically enlarges to several times its "normal" monitor size. Very nice when the sending station starts asking what you see in the image.

You will find a lot of options to choose from as you go through the setup process. One that I wasn't sure if I had chosen (may be default) is when you have the program in the "Auto-Receive" mode, it not only recognizes a transmitted image but will select the correct mode to receive. I learned this from watching as a different transmitted mode came in, the SSTV mode in ChromaPIX immediately changed to match. A very nice feature, especially if you miss what the other operator states as the SSTV mode.

You will soon find SSTV is just as addictive as any of the other digital modes. And you will also find the folks who are already into the mode are extremely helpful. You won't fail. I was discussing some of this with another ham who was just trying out the ChromaPIX. He was remarking about the encouragement he was receiving as well as constructive advice. My thought is that most of the hams who are involved have seen the oft repeated problems and recognize them right away. And here is a place where a picture is truly worth a thousand words. The explanation of the symptoms are right there on the monitor.

I mentioned about building image files which organizes your efforts to recall stored images after a few days. ChromaPIX is all set to help you with this file management. You can instruct the program where to save the images you receive over the air with an Autosave function and, if you don't mess with the process, the files will be numbered for help in recall later.

You will find editing capabilities to aid in customizing the image as well as adjusting the colors. I find that often the color needs help after scanning an image into the system. I also have a separate graphics program for the heavy duty resizing, file conversions, etc., but for the most part, there is enough to add whatever special effects you want within ChromaPIX.

There are two other "extras" included in the package. One is a module to import directly from your scanner to ChromaPIX or to the Windows clipboard. This can be a step-saver. Plus, there is a module to import from your video camera. I am having a difficulty with my scanner which requires a few extra steps to establish communication with Windows. I found the ChromaPIX scanner module reacted the same way which meant no new learning curve and it worked as promised.

You will discover a nifty feature that is allowed between ChromaPIX users. When

you are receiving an image from another user and he has the "caller ID" function enabled, his callsign will be displayed below the image and will remain encoded in the image so you will know later where the image originated when you view it from your file.

There simply isn't room enough here to comment on all the bells and whistles in the software package. I don't think they covered it 100% in the 30+ page manual. The program is truly sophisticated. They have done a great job and it works. The manual does have many detailed images to guide you by example with setup and use.

You will never really understand what is there until you try it. And the demo is uncrippled and free for the download. The only real encouragement (read: nagging) the software gives you to register is it will simply quit and shut down every 30 minutes until you register (pay money). And believe me, when you are into this program, 30 minutes simply flies by, but you will be able to evaluate quite well within a few 30-minute sessions if this is what you want to do with this mode in ham radio. It IS fun.

A few weeks ago, I had an interesting experience — thrilling by some standards. I was working a bit of PSK31 from my high power system at about 50 watts and signed with the station when I noticed a not quite complete appearing call on the screen — "down in the mud" as we tend to say.

I gave it a reply, though I wasn't sure if it really was for me or was just my imagination. The station came back from New Jersey and, to both operators' surprise, turned into a decent QSO. It turns out he was using one of the little QRP rigs that come as kits and was running 2 watts into a vertical or some other single element radiator. My memory fades a little on that detail.

The point is, here we were at a busy time on the band, plenty of competition for the frequency and he was maintaining very good communication on this narrow mode with minimal radiated power. It speaks very well for the capabilities of PSK31. Hams are doing great things with this mode. There is no need for expensive amplifiers and it is beginning to look like expensive rigs aren't required either.

I was thinking how, about a half century ago, I would snag some DX across the country on 40 meter CW with about 4 watts, but would have to stay up half the night until everything was "just right." Here was a successful QSO on PSK31 at the busy time of day. I was impressed — still am.

Speaking of these things, there is another mode that is doing quite well, and I mentioned it last month. Look around 14.080 and listen for an "out-of-place" SSTV-sounding warble. It is MFSK16. That mode keeps getting busier all the time. Nino IZ8BLY, has a real winner on his hands this time. The software, Stream, is free for the download and listed in The Chart (**Table 1**).

I received an E-mail recently from a ham who was a bit intimidated by the info in this column. It seemed to him I wasn't addressing the needs of the "wannabe" digital enthusiast. I apologized for that, and do so to any who feel this way as well. The reason I started this column a few years back was to develop interest in the digital modes and, in the process, improve my comprehension.

Well, as I explained to the inquiring ham, when I became proficient, the simplicity must have dropped a notch or two. Then I went on to address his specific questions and discovered I was referring him to specific sites I have listed in the chart for further reading to fill in the chinks on the basics. What occurred to me then was I am depending on people to do just that but some of the verbiage I write doesn't point to those Web sites as telling the story. So ... the truth is just about everything I tell you is found on the Web sites I direct you to in The Chart. You scarcely need me for anything but a cheering section <smile>.

If you have questions or comments about this column, E-mail me [jheller@sierra.net]. I will gladly share what I know or find a resource for you. For now, 73, Jack KB7NO.

Source for:	Web address (URL):
Mix W Soundcard program for PSK31, RTTY, new modes, MTTY, FSK31, more	http://tav.kiev.ua/~nick/my_ham_soft.htm http://users.nais.com/~jaffejim/mixwpage.htm
MMTTY New RTTY soundcard freeware plus links to other software	http://www.geocities.com/mmtty_rtty/
TrueTTY — Sound card RTTY w/ PSK31	www.dxsoft.com/mitrtty.htm
Pasokon SSTV programs & hardware	www.ultranet.com/~sstv/lite.html
PSK31 — Free — and much PSK info	http://aintel.bi.ehu.es/psk31.html
Interface for digital - rigs to computers	www.westmountainradio.com/RIGblaster.htm
Interface info for DIY digital hams	www.qsl.net/wm2u/interface.html
WinWarbler info and free download	www.qsl.net/winwarbler/
Site with links to PSK31 and Logger 7, also Zakanaka	www.geocities.com/kc4elo/
PSKGNR — Front end for PSK31	www.al-williams.com/wd5gnr/pskgnr.htm
Digipan — PSK31 — easy to use — new version 1.2	http://members.home.com/hteller/digipan/
TAPR — Lots of info	www.tapr.org
TNC to radio wiring help	http://freeweb.pdq.net/medcalf/ztx/
ChromaPIX and ChromaSound DSP software	www.siliconpixels.com
Timewave DSP & AEA (prev.) products	www.timewave.com
Auto tuner and other kits	www.ldgelectronics.com
XPWare — TNC software with sample DL	www.goodnet.com/~gjohnson/
RCKRtty Windows program with free DL	http://www.rckrtty.de/
HF serial modem plans & RTTY & Pactor	http://home.att.net/~k7szl/
SV2AGW free Win95 programs	www.raag.org/index1.htm
Source for BayPac BP-2M & APRS	www.tigertronics.com/
BayCom — German site	www.baycom.de/
BayCom 1.5 and Manual.zip in English	www.cs.wvu.edu/~acm/gopher/Software/baycom/
Int'l Visual Communication Assn. — nonprofit org. dedicated to SSTV	www.mindspring.com/~sstv/
Creative Services Software	www.cssincorp.com
Hellschreiber & MT63 & Stream & scope	www.freeweb.org/varie/ninopo/iz8bly/index.htm

Table 1. The Infamous Chart ... updated monthly.

QRP

Low Power Operation

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On to the HW-9

With most of the smaller projects out of the way, as promised, I'll now dive into the Heathkit HW-9 QRP transceiver.

The HW-9 was produced from 1984 to 1991. It was the last of the QRP transceivers Heathkit offered. In fact, the HW-9 was sold right up to the end of kit production by Heathkit. The barebones HW-9 sold for $249.95 without the band pack. It was one of the first kits Heath produced that appeared in the light brown color scheme.

The HW-9, a complete redesign of the HW-8 Heathkit, started out with a clean sheet of paper. The only thing they kept in the old design was the shape and size of the cabinet.

Out of the box, the HW-9 covers the first 250 kHz of 80, 40, 20, 15, and 10 meters. You could add on the optional band kit to get the WARC bands as well.

Unlike with the HW-8, there is no front-end amplifier used in the HW-9. Instead, the HW-9 uses a balanced mixer and a broadband design. There's no front-end peak control to mess with as in the HW-7 and HW-8, thanks to the broadband front end. Selectivity is provided by a 4-pole crystal filter and an active audio filter as well. Selectivity is 1 kHz at 6 dB down and 250 kHz (narrow setting) at 6 dB down. Sensitivity is rated at 0.2 µV.

The transmitter is quite robust in the HW-9. Running at least 4 watts output on all bands except for 10 meters, most HW-9s routinely produce over 7 watts of output. The RF output is continuously variable.

The HW-9 does not include an internal power supply, and requires 12.6 volts at one amp. It will work from 11 to 16 volts.

Also included in the HW-9 was full break-in CW. This worked OK until you got up around 20 wpm — then the keying got a bit sluggish and started to run the characters together.

Heath also included an S-meter that worked on receive, too. Just bells and whistles, but nonetheless it is an S-meter.

Building the HW-9

The HW-9, like any other Heathkit, needed to be assembled. For the HW-9, all you needed was a VTVM and frequency counter. Instead of counting parts and checking them off, this time Heathkit had the parts mounted on tape. You then cut out the part and inserted it into its proper location on the PC board. You repeated the step until the tape segment was used up. I built an HW-9 using this method, and although it is a lot easier than looking for a part in a pile of parts, it's not much fun! Clearly, many could see the changes coming down the road for Heathkit.

There are two PC boards inside the HW-9. On the top half of the HW-9, you find the oscillator board. And just as the name implies, all the oscillators used by the HW-9 are located on this PC board, including the VFO. On the bottom half of the HW-9, you'll find the T/R circuit board. Here the filters for the front end and band switches are located. Also, the final amplifier transistors are located in a cramped corner of this board.

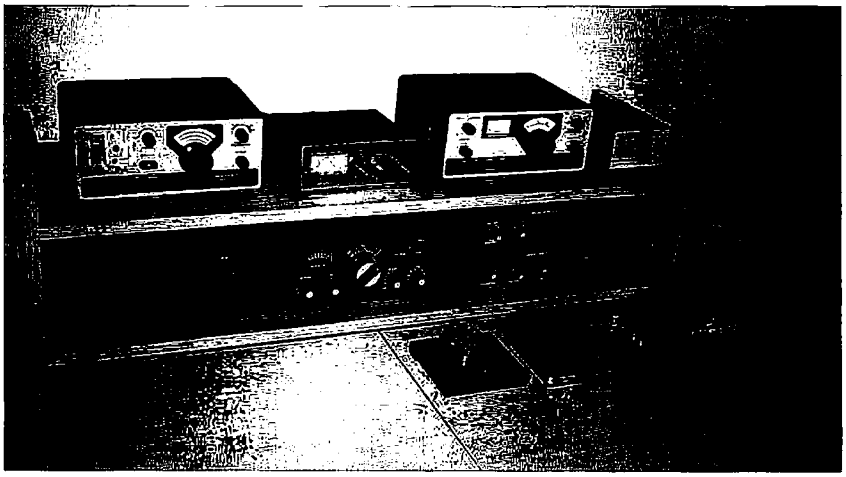

Photo A. Here's the QRP station of Mike Kassay VE3MKX. Top row, left to right: HW-7, HW-8. Bottom row: HW-9 with speaker, and wattmeter/antenna tuner.

Operating the HW-9

If you've worked with an HW-8, the HW-9 superhet receiver will surprise you. No longer do you have to be sure you're on the correct sideband to make a contact. The audio filter works great, and there's plenty of audio to drive a speaker if you desire. The QSK, while a bit sluggish at higher speeds, does work quite nicely. And overall, stability is typically less than 500 Hz after a 30-minute warm-up. The rig will settle down to 150 Hz per 30 minutes after a 90-minute warm-up.

Some Common Problems

You can't mention the HW-9 without talking about the VFO drive. They have a history of drive troubles. Mainly, the VFO slips as you try to tune the radio. Luckily for us,

Heathkit quickly became aware of the problem and issued a fix. Here is the official Heathkit fix for the VFO drive problem. One caution: The parts listed in the fix are obviously no longer available from Heathkit, so some "field forming" may be necessary.

May 29, 1987
HW-9 QRP CW Transceiver
Bulletin No.: HW-9-8
VFO Dial Slips or Binds

Since the introduction of the HW-9 transceiver, it has had a history of VFO dial slipping or binding problems. These problems are caused by different parts of the VFO assembly. Here are some of the areas of the VFO assembly which cause the slipping or binding problems and some fixes to correct them. Also given is the new method of mounting the VFO capacitor. If all else fails, make the changes given in the "New VFO Capacitor Mounting Procedure."

The vernier drive assembly (P/N 100-1839) in the first production run of HW-9s didn't meet torque ratio specs. This caused the dial to slip. To identify this vernier drive assembly, see if it uses #6 setscrews. If so, it's an earlier drive assembly. Replace it with a vernier drive assembly that has #4 setscrews installed. These drive assemblies meet torque ratio specs. The drive assembly with #4 setscrews are in second production and later HW-9s, and also in Heath Part Replacement stock.

In some cases, the dial will slip or bind only after installing the VFO shield (P/N 206-2692) over the drive bracket (P/N 204-2692). Engineering corrected this problem by changing the thickness of the drive bracket from 0.041" to 0.030". Because of the small change, it's difficult to tell which drive bracket is installed. If the dial slips only when you install the shield, move the lockwasher on the vernier drive from the inside of the drive bracket to the outside of the bracket. This will allow the VFO shield to slide easily over the drive bracket, removing tension on the drive.

Misalignment of the shafts of the variable capacitor and the vernier drive assembly will also cause dial slippage. If the capacitor frame is not bent at a right angle at either corner, the shaft will be misaligned and the dial will slip. To correct this, install a #6 flat washer (P/N 230-60) between the rear of the capacitor frame and the drive bracket at the two locations shown in Fig. 1. This drawing *[not in this 73 — ed.]* shows the 6-32 x 1/8 screw into the drive bracket, and then the flat washer placed on the screw before it is attached to the capacitor frame.

Photo B. *The Heathkit QRP trio.*

New VFO Capacitor Mounting Procedure

The following method is used to mount the VFO capacitor in the HW-9 transceiver to minimize dial slippage and binding. This change will be installed in the next production run of HW-9s.

Parts required (one each; Heath P/N in parentheses): drive bracket (204-2909); 4-40 x 15/16" screw (250-480); 4-40 nut (252-2); #4 lockwasher (254-9); rubber grommet (73-53).

Procedure:

• Install the rubber grommet at hole GA of the new drive bracket.

• Push the 4-40 x 15/16" screw through the grommet at GA. On the inside of the bracket, place the 4-40 nut and the #4 lockwasher on the screw. Turn the nut about 1/4" onto the screw.

• Set the capacitor/drive assembly into the bracket. Turn the 4-40 x 15/16" screw into the indicated hole of the variable capacitor until the screw end is flush with the inside edge of the capacitor frame. Tighten the 4-40 nut against the capacitor frame.

• Tighten the control nut and rotate the shaft to make sure it turns smoothly. *[End of bulletin. — ed.]*

Next time, I'll take a closer look at the insides of the HW-9, with a few fixes. Also, I'll show you more official Heathkit fixes for the radio, as well as a few modifications.

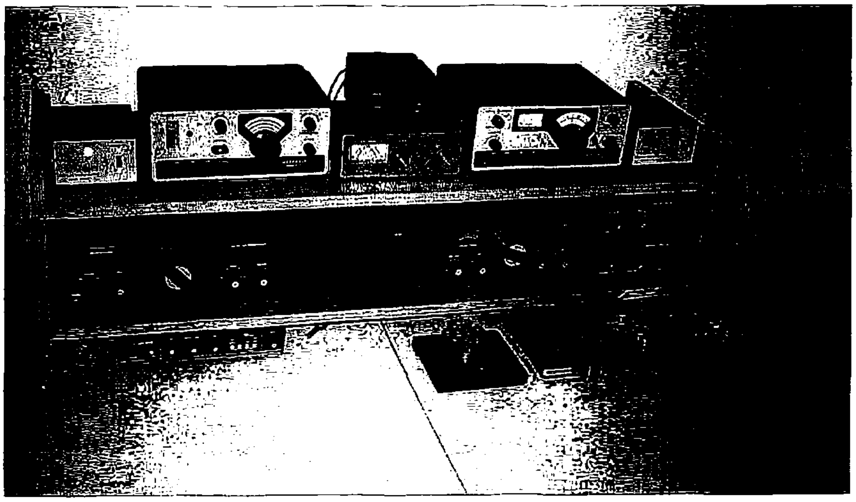

Photo C. *Again, Mike's station, but this time he has added the HW-99 (left), an HW-9 on steroids.*

The DX Forum

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Flash! N6NR blows it big time!!

Were you looking for a January DX Forum and couldn't find it? Be assured that your eyesight is totally intact. I had a total flameout on last month's issue. I told everybody it was because I was sick in bed with the flu, which was true. But what really brought me to parade rest was the fact that the whole article was devoted to the latest version of MMTTY. I hope you read Jack KB7NO's review in the DECEMBER issue instead.

Back around September (or was it August?) I wrote a piece on the 25th Anniversary of the founding of the Central Arizona DX Association, and the celebration that was planned. I admit that I had a tiny bit of self-interest in that story, as I am one of those charter members.

As it turns out, I was not able to get down there for the celebration, which was a big disappointment for me. However, a few days ago I received a "care package" from Bob K7BHM, the club historian. In it was some pictures of a few of the attendees. But there was booty as well.

Keep in mind that as I write this, there is snow falling outside, and it is a few weeks before Christmas (darn the production delays associated with printed media). Well, thanks to the CADXA, Christmas has already arrived. What I received was a beautiful coffee mug (no cheap knockoff, this one is really nice), and a mouse pad — both monogrammed with the CADXA logo, and some words commemorating its 25th anniversary year. But that's not all. I also received a very nice blue pen with my name and call engraved in gold lettering. Totally way cool!! I also had a camera flameout this month, so maybe one of the future issues of the DX Forum will contain a shot or two of my newly acquired DX memorabilia.

The reason why I mentioned this has nothing to do with me, but rather to illustrate just what a superb group of DXers the Central Arizona DX Association is, and always has been for that matter. To invest that amount of time and money to honor those who "kicked the flywheel" of this fine organization into motion, speaks volumes about the quality of the people that comprise it. My hat is off to the CADXA, and here's to another 25 years of DXellence!

Hamshack tours

I was supposed to start this feature last month, but oh never mind. Every few months or so, we will take a snapshot of some of the DXers who roam the bands, some great, and some small. In the early installments, most of the material will come from personal Web pages on the Internet. It is hoped, however, that you will take delight in sending some photos and station descriptions, bios, etc., via snail mail.

This month I thought I would feature a ham who is representative of the many newcomers to the joy of DXing. By newcomers, I mean within the last decade. Featured here is Charles Johnston AB7SL, who lives in Prescott AZ. Here is some data about Charles in his own words:

"I was born on December 27, 1950. I'll soon be 50 years of age! I spent the first 27 years of my life in Kansas City KS, minus a stint onboard the nuclear fast attack submarine *USS Aspro* SSN 648 during the Vietnam crisis. Once as a child my dad had me listen on the AM broadcast band late one

Photo A. Here are the charter members of the CADXA at the Silver Anniversary meeting. From left to right are N7CW, W7IUV, K7SA, N7US, W7XA, K7BHM, K7NN, AA7A, W7RV, N7RK, K6AIA, K7SP, N7MW, N7RT, NE7X, NN6R (no, not a typo).

night to stations coming in from cities all over the USA. That really was my first experience with my love for radio.

"I moved to Arizona in 1977 and continued working as an electronics technician, primarily on microwave devices and subsystems. I became disabled in 1992 and shortly thereafter got my first ham radio license as a No-Code Tech in May of 1995. By November of the same year I had advanced to the top license (Extra Class), which I enjoy to this day.

"I enjoy working DX (foreign stations) and chatting with my regular friends on the ham bands. Since March of 1996 I have made contact with over 280 different DX countries. I hold several awards such as [http://www.arrl.org/awards/was/], Worked All States; [http://www.arrl.org/awards/wac/], Worked All Continents; [http://www.arrl.org/awards/dxcc/], DX Century Club; and [http://www.cq-amateur-radio.com/wazrules. html], Worked All Zones.

"My lovely wife, Jan, is also an amateur radio operator. We stay in touch over 2m (144 MHz) split frequency whenever either of us are away from home. She has been the best thing that has ever happened to me. To have her makes me one lucky and very grateful guy.

"Obviously computing is another hobby of mine. My typical day is comprised of amateur radio and computing — not too bad, I'd say — my own goal is to make DXCC Honor Roll. My station is modest, I only work single sideband. My antennas are simple dipoles. My battle cry is 'Honor Roll on a Dipole!'"

Charles's station includes the following:

Transceivers:

Kenwood TS450S/AT HF Transceiver 10-160M All Mode 100W.

Two - HTX 212 2m Radio Shack transceivers 45W - one base - one mobile.

HTX 202 - 2m Radio Shack transceiver 7W - used for Packet Station.

Linear Amplifier:

Ameritron AL811-H Linear Amplifier - 800W PEP.

Antennas:

W9INN 5-Band (10-15-20-40-80m) inverted "Vee" antenna 50 ft. above ground.

Home-brew 17m inverted "Vee" antenna 50 ft. above ground.

Ringo Ranger II 2m Base Antenna at 55 ft. above ground.

Comet B-10M 2m/70cm Dual Band Mobile antenna.

Three-element 2m Yagi for DX Packet Cluster at 30 ft. above ground.

Microphones:

Astatic "Limited Edition" Diamond Eagle D-104 on amplified stand.

Astatic 10-DA "Super Sideband" mic on amplified stand.

Astatic "Silver Eagle" D-104 on amplified stand.

Computer System:

Dell Dimension L566cx desktop computer. 566 MHz Celeron CPU. 128M RAM.

56k-v90 modem. 48x CD-ROM drive. 17-inch Dell monior. 7.5G hard drive.

Microsoft Windows Millennium (WinMe) operating system.

American Power Conversion - Back UPS Pro 420 - Uninterruptible Power Supply.

Charles has done a nice job with his Web site. You can view some close-ups of his equipment, as well as some very nice high-resolution photos that are quite pleasing to the eye. You can also catch a glimpse of who he has been working lately. I noticed that he recently worked 9H1EL, and 7X4AN. Not bad. Keep goin'!

I highly recommend that you stop by his Web site, and have a peek for yourself. His URL is [http://www.ab7sl.com]. That should be an easy one to remember.

Vox populi

The December issue saw the inauguration of this section of the DX Forum, and it was very well received. I got hate mail, and great mail as well. Remember that the intention here is to provide a forum for DXers to express their opinions. The only editing these comments might receive is the elimination of tasteless language, which, by the way, has not been necessary.

There has been a certain amount of discussion lately concerning the juxtaposition of high-power and low-power stations in the pursuit of rare DX. Coupled with this discussion is the question as to whether the DXCC Honor Roll is unattainable for those who don't grow aluminum on a 40-acre spread. I don't recall who originally raised the question here, but as it turns out, it is one that has been asked many times over

Photo B. And here is a smaller group at a reception held at the home of Bob K7BHM. Standing are K7SP, N7MW, K7BHM, W8AEF. Seated are NN6R (again, no typo), N7US, NE7X, K7SA, and W7XA. I can't believe it. The only guy that looks close to what he did 25 years ago is Mike N7MW.

the years. Here are some comments that are reprinted from the NJ DX reflector (with permission from the respective authors). The thread is entitled: Big Dogs and Little Dogs.

"I'm certainly no big gun with my TS570D and vertical antenna. Sometimes there is a 3-500z active between the two, but with a pair of $2.00 headphones, I've been able to work 318. If the 7O1YGF turned out good, it would be 319. I work them when and how I can, and I've learned to find where the operator is listening in the pileup, which direction his finger is heading, and to guess well where he might be next. I have no spare money to spend on this stuff; one of my kid's health problems takes care of any spare change I might have had, so I chase the DX on a budget. No, I didn't work K5K the first night they came on even though I tried. By the second night though they were in the log. Ultimately I worked them on every band and mode I heard them on. I'm no big gun by any stretch. I have learned the value of patience. — Gary AB5RM."

"I don't agree [that the Honor Role is out of reach for the average DXer]. While I have a $2000 radio and a $2000 kW, I have worked 310 countries since October 1997, only missing a couple to the real BIG DOGS (FR/Glorioso comes to mind). I could just have easily worked all those with my backup TS-930 (around $500 on the used market) and MLA-2500 (also about the same). All with a G5RV dipole strung between two trees about 35 feet off the ground.

"All it takes is vigilance, diligence and patience. 73. — Jim AD1C."

"I worked the millennium award with my 1966 Hallicrafters Hurricane. Final contact was with FOØAAA on 10 meters, split.

"As administrator of the Vintage Radio DX100 Award, I receive applications listing contacts with some rather choice and somewhat rare DX stations done with 'Vintage' gear, some at 40 watts or less.

"Yes, I have some of the most recent ICOM transceivers but the proof is in the pudding; the old gear still does the job and fairly inexpensively.

"As far as HUGE antennas go I worked the K5K group with one (I am waiting for the logs to be posted, but I will stick my neck out) using 11 band modes. Unfortunately (for me) the starter capacitor for my rotator that drives the monobanders went out about 2 weeks before they were QRV. Adding to that high winds bound the mast on my other tower (TH6DX at 45 feet) both, as Murphy would have it, ended up locked to the north! That happened midway through their operation leaving the station with verticals and wire. I must admit I did run power on most bands; an IC2KL at about 400 watts.

"Give credit to the ops at the other end. They are there to make QSOs! Listen to their operating habits; study a bit of propagation; forget being numero uno QSO. — Dave Paperman W5WP 7BDXCC(SSB), DXCC (CW), etc., etc., etc."

"I know it is NOT necessary to be a big gun to make the DXCC Honor Roll because I made it. My antenna is a TH-5 at 26 feet on a roof tower. That makes me a 'big gun'? RIGHT!

"There is not now, nor has there ever been, any guarantee to work any given station while you are running high or low power, using a big or little antenna. A lot of QRP operators have made honor roll. Some people think skills are developed over time that help in this endeavor.

"I first made DXCC running 100 watts to a vertical. I spent many, many hours calling in pileups to no avail. But I really felt good when I finally did work them. If you learn to operate, you will make honor roll, but maybe not by tomorrow afternoon. Took me many, many years. — de Vic AE5DX."

"NO NO NO!!! When I made the Honor Roll, the best rig I ever had was a Ten-Tec OMNI D and a Clipperton-L amp that can barely squeeze out 750 watts and a tribander that was never over 50 feet high. I am modestly convinced that my DXCC success is 10% station and 90% operator! — Bill W5EC."

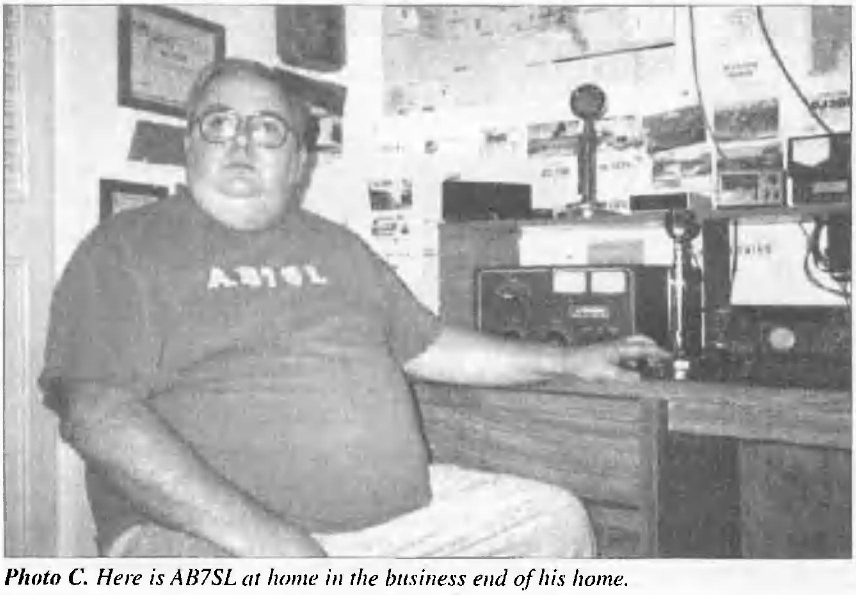

Photo C. Here is AB7SL at home in the business end of his home.

Based on the comments above, you may assume that the consensus is that being a little pistol is not necessarily going to exclude you from the lofty goal of ascending to the rarified air of the Honor Roll. In fact, my friend Dave N7KZN and I were just talking about this recently, and he reminded me that he worked over 300 countries with 100 watts and a dipole from his home near Bremerton WA (almost exclusively on CW, I might add). It CAN be done.

After reading through the responses in this thread, I called a couple of my big dog buddies to get their opinions (for their safety, I promised to keep their identities a secret). They both said that they try to come and go quickly, and with their high effective radiated power, they can pretty much "pounce and run" on the first, or second call, and be out of everyone's hair. What I didn't expect to hear was their polemic directed at fellow big dogs who, when they hear a rare one, will obliterate those who are trying to work that station for the first time, and then proceed to carry on a ragchew until favorable propagation has faded away.

So what do you think? Send me an E-mail or a note to the address listed in the header of this column. I promise that your correspondence will be well received, regardless of whether you agree or not.

Pulling the big switch

So much for this month's offering. I hope the opinions expressed in Vox Populi didn't cause you to take offense. It wasn't intended to, at least not by me. Until next month.

73 and good DX!

All About Class D Amplifiers

continued from page 22

THD + noise isn't anything to brag about, it is pretty good.

Big brutes of audio amplifiers, kilowatts, can be built with little or no heat sinks. High efficiency audio amplifiers are no longer just academic curiosities. They are here and now. High power class D amplifiers are certainly in the realm of possibility without being a boat anchor.

Portable Personal Repeater

continued from page 24

6 dB on UHF with an NMO connector. So why not just use that?

I lined the inside of the camcorder case with aluminum foil so that it will serve as a ground plane as shown in **Photo A**. Obviously, if you use one of those high-end camcorder cases that is constructed of aluminum, the case itself will be the ground plane. These are not as common surplus and are more expensive. To glue the aluminum foil to the inside of the case, I used spray Scotch brand photomount glue. This stuff works great since it spreads well evenly. After mounting the foil, I drilled the hole for the NMO connector and mounted it. When the foam is replaced, the aluminum foil is completely hidden.

Photo B shows the case open as it is ready to be put into service. The insides consist of a power supply for charging the gel-cell, the Alinco 580 which is used as the cross band repeater, and two Yaesu FT-470 dualband HTs which are used as the radios. Shown also is the optional solar panel. The panel shown only provides about 100 mA in sunlight. It cannot sustain the battery continuously if the transmit duty cycle is high. **Photo C** shows how the repeater was placed at about 5500 feet with the use of snowmobiles.

The repeater worked great. I operated it in McCall ID, and was able to stay in contact with a repeater in Emmett, about 60 miles away. We were at about 2,500 feet on the side of the mountain. The crossband repeater also operated flawlessly from HT to HT, one operating at VHF and the other operating at UHF. It covered the entire line-of-sight area in McCall. I was able to travel easily 15 miles into town and still hit the repeater with a full quieting signal.

So, the next time you plan to travel to some remote ski resort or campsite, consider using a crossband repeater and placing it on the local hill. Just don't forget where you placed it since it can snow heavily during the night and cover up the repeater. You'll be pleasantly surprised how much a 2 watt repeater will extend your range. Also, don't forget to ID that you are transmitting through a crossband repeater.

Inside Digital TV/VCR Tuners

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worked following the same process described. As a caution, when cutting the paper mask for IC pins and other closely spaced pad areas, use the knife blade press technique to prevent pulling on the paper. Also, after cutting adjacent pads, brush each with nail polish and allow it to dry. The polish will help hold the paper mask in place during the cutting operation.

When the entire desired trace pattern is covered with nail polish, allow the polish to dry completely — about 30 minutes is sufficient. Then carefully remove the remaining paper mask, exposing all of the copper that is to be removed during the etching process as shown in **Photo F**.

At this time, the board pattern must be inspected thoroughly for trace bridging, errors in the polish placement, etc. Corrections are easily made at this point using a knife blade to remove unwanted polish. Running the tip of the knife blade between IC pads will ensure that the copper is exposed for removal during etching.

If nail polish is missing, or if the trace area needs to be repaired, polish can be brushed onto the copper in those areas. After the polish dries, it may be shaped as desired using the knife blade.

The last part in this series will complete the process of making boards for the data transmitter and receiver.

Crystal Oven Controller

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wave. When the controller is switched off, there is still a low level (0.7 Vp-p) voltage on the transformer secondary. This residual voltage produces only about 15 milliwatts of heat. With the new control circuit, after a one-hour warm up, the oven heater cycles on for 4-1/2 minutes, off for 3-1/2 minutes. The average power is only 5.6 watts. For this low power application, the solid state relay stays cool to the touch and requires no additional heat sink.

Continued on page 61

Jim Gray II
P.O. Box 22799
Juneau AK 99802

Special Forecast

It looks like solar activity in February will again range from very high to intense. I had been looking for a slight decrease and an associated improvement in conditions, but that is not to be.

Expect poor conditions to persist throughout the month, with only a slight improvement during the last few days. The worst period will be from the 9th through the 15th with a geomagnetic storm being quite likely.

The lower bands and morning gray-line propagation will provide the most interesting opportunities. Stations located in the southern U.S. will definitely have the advantage over northern ones, but night owls and early risers everywhere should fare the best.

Hang in there! — Jim [akdhc2pilot@yahoo.com].

Band-by-Band Summary

10 and 12 Meters

Opens to the east in the morning hours and follows the sun, finally closing in Asia during the late afternoon. No openings are expected at night and daytime performance will deteriorate with the approach of Spring. Short skip usually ranges from 1,000 to 2,500 miles.

15 and 17 Meters

Will provide better daytime opportunities than 10 and 12, especially into the southern hemisphere. Signals peak toward the east before noon, to the south around midday, and to the west in the afternoon. Short-skip can be expected to be about 1,000 miles.

20 Meters

This should begin to improve at night, but is the best overall band for daytime operation. Openings begin at sunrise and last into the evening hours. Short skip will average between 500 and 2,500 miles.

February 2001						
SUN	MON	TUE	WED	THU	FRI	SAT
				1 P	2 F-P	3 F-P
4 F-P	5 F-P	6 P	7 F-P	8 F-P	9 VP	10 P
11 P	12 P	13 P	14 P	15 F-P	16 F	17 P
18 F-P	19 P	20 P	21 F-P	22 F	23 F	24 F
25 F-G	26 F-G	27 F-G	28 F			

30 and 40 Meters

Best at night. Africa, the Middle East, and Asia ought to provide the most opportunities. These bands should be relatively quiet this month with the most atmospheric noise occurring

EASTERN UNITED STATES TO:												
Central America	15 (40)	20 (40)	20 (40)	(40)	(40)	(20-40)	(15) 20	10-20	10 (20)	10-17	10 (20)	(10) 20
South America	(15) 20	20 (40)	20 (40)	20 (40)	x	x	(15-20)	x	(10)	10 (15)	10 (20)	(10) 20
Western Europe	40	40	40	40	(40)	x	(10-20)	10 (20)	(10) 20	(15-20)	(20)	(20-40)
Southern Africa	(20-40)	(40)	x	x	x	x	x	(10-12)	10 (17)	(12) 17	(15-20)	20
Eastern Europe	(40)	(40)	x	x	(20)	x	(10-20)	(10) 20	(20)	x	x	x
Middle East	(40)	(40)	x	x	x	x	(10)	(10-15)	15 (20)	20	(20)	(20)
India/ Pakistan	x	x	x	x	x	x	x	(15-20)	x	x	x	(20)
Far East/ Japan	(15) 20	20	(20)	(20)	x	x	(20)	x	x	x	x	(10-20)
Southeast Asia	(15-20)	x	x	x	x	x	x	(10-20)	(10-15)	x	x	x
Australia	(10-17)	(15-20)	x	x	(20)	(30-40)	(20-40)	(10) 20	(10-20)	x	(20)	(10-15)
Alaska	15-17	20-30	x	x	x	20-30	20-30	15-17	15-17	x	x	15-17
Hawaii	(10) 15	(20)	20	(20)	20 (40)	40	(20-40)	(20)	(15-20)	x	(10)	10 (15)
Western USA	(10) 40	(15) 40	20-40	(20) 40	40	40	40	(20-40)	(10-20)	10-20	10-20	10-20
CENTRAL UNITED STATES TO:												
Central America	(15) 20	20 (40)	(20) 40	(20) 40	(20) 40	40	(40)	(10) 20	10-20	10-15	10 (20)	15-20
South America	(15) 20	20	20 (40)	20 (40)	(20)	x	x	x	(10)	10	10 (20)	(10) 20
Western Europe	(40)	40	40	(40)	x	x	(20)	(15) 20	(10) 15	(15) 20	(20)	x
Southern Africa	20	(20)	x	x	x	x	x	x	(10-15)	(10) 15	15 (20)	20
Eastern Europe	x	(40)	x	x	x	x	x	(10) 20	(10-30)	x	x	x
Middle East	x	(40)	(20)	(20)	x	x	x	(10-15)	(10-15)	(20)	20	(20)
India/ Pakistan	x	(15)	x	x	x	x	(20)	x	(15)	x	x	x
Far East/ Japan	x	x	(20)	20	(20-40)	(40)	(20)	20	(15-20)	x	15	(15)
Southeast Asia	x	x	x	x	(20)	(20)	20	(15-20)	(15)	x	(15)	x
Australia	(10) 15	15	(15-20)	20	20 (40)	20-40	20 (40)	(20)	x	x	x	(10-15)
Alaska	15-17	15-17	x	x	x	(40)	(40)	20	20	x	x	x
Hawaii	(10) 15	(15-20)	20	20	(40)	(20-40)	20 (40)	x	(15)	(15)	(15)	(10) 15
WESTERN UNITED STATES TO:												
Central America	(20-40)	40	40	40	(40)	x	(20)	(10) 20	10 (20)	10 (20)	(10) 20	(15) 20
South America	17 (40)	(20)	x	x	x	x	x	(15)	12 (20)	10-20	10-20	12 (40)
Western Europe	x	x	(40)	(20)	(20)	x	(20)	(10-20)	(10) 20	(20)	x	x
Southern Africa	(20)	x	x	x	x	x	x	x	(10)	(15)	15 (20)	(15) 20
Eastern Europe	x	x	x	x	x	x	x	x	x	x	x	x
Middle East	(20)	(40)	(20)	20	20	(20)	x	(15)	(10) 15	(10-15)	(20)	(20)
India/ Pakistan	(15-20)	x	x	x	x	x	x	(20)	x	x	x	x
Far East/ Japan	(10) 20	(15-20)	x	x	(40)	40	(40)	x	x	x	(10-20)	10-20
Southeast Asia	(15)	(20)	x	x	x	x	x	(20)	(15) 20	(20)	(10-15)	10-15
Australia	(10-15)	(15-20)	x	x	x	(20-40)	(20-40)	20	(15-20)	15	(10-15)	10
Alaska	10-15	x	x	20-30	20-30	20-30	20-40	x	20	15	x	15-17
Hawaii	(15) 20	(15) 20	20	(20)	(40)	40	(20-40)	(15) 20	15 (20)	(10-15)	10 (15)	(10) 15
Eastern USA	(10) 40	(15) 40	20-40	(20) 40	40	40	(20-40)	(10-20)	10-20	10-20	10-20	10-20

Table 1. Dual numbers indicate that the intervening bands should also be usable. When one number appears in parentheses, that end of the range will probably be open on Good (G) days only.

across the tropics. Short skip is under 700 miles during the day but extends beyond 1,000 miles at night.

80 and 160 Meters

Expect some nice surprises again if atmospheric static isn't too strong. Short skip on 80 is over 2,000 miles at night but only around 300–400 miles during the day. 160 meters will provide limited nighttime opportunities with skip averaging between 1,000 and 2,000 miles.

Crystal Oven Controller

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With the help of a few solid state components, a very well designed and reliable vacuum tube circuit continues to live and serve a useful purpose. Overall, I am very pleased with the circuit and plan to use it in the final system for a very long time. I might even incorporate the oven controller design into several other pieces of equipment having thermostatically controlled ovens.

Need a Noise Blanker?

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receiver in an automobile having no ignition noise suppression. In this case, reception without the noise blanker was nearly impossible unless the signal was exceptionally strong. With the noise blanker, even the weakest signals are not bothered by the ignition noise.

Batteries B1 through B4 will last approximately as long as their shelf life, since the current drawn by the reverse-biased diodes is only a few microamperes (µA). Fresh batteries will last for about a year of normal usage before showing signs of leakage — an indication that they must be replaced.

Homing In

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unchanged and add corresponding age divisions for females? Maybe we should leave everything just as it is until more females join the sport here. I want your opinions.

As the number of divisions goes up, a problem at smaller ARDF events will be too few competitors in some divisions (**Photo E**). The European rules committee is considering adding provisions for combining divisions at events whenever the total number of persons in two adjacent age divisions is less than those in other divisions.

Even a large number of divisions won't completely eliminate inequities. For instance, 54-year-old Marvin Johnston KE6HTS had to compete against 40-year-olds in the Old-Timer Division in China last year. Next World Championships, unless the rules change, most of the members of his new division (Veterans) will be older than he will be.

A mathematical technique has been developed to deal with these situations. It's employed in some countries at marathons and other running events, but hasn't received much consideration by marathoners stateside or ARDFers anywhere. "Age-Graded Scoring" uses statistical tables to compare performances of athletes of different ages and genders. An individual's finish time is weighed against the "ideal" time for a person of the same age and gender, giving a percentage score. Even if your finish time worsens over the years as you advance in age, your increasing skill may be reflected by a better age-graded score.

Is age-graded scoring something to consider for ARDF? Implementation will require that tables of ideal times for ARDF be developed. That may be impossible, because radio-orienteering courses have substantial variations in difficulty — much more than marathon courses, which are always the same length and don't involve off-trail running. Again, I welcome your comments and suggestions. My electronic and postal addresses are at the beginning of this article.

RESOURCES

USA ARDF Championships
July 31–August 4, 2001

Postal Mail: Albuquerque Amateur Radio Club, P.O. Box 11853, Albuquerque NM 87192.

E-mail: [aarcardf@egroups.com] for private inquiries; [abqardf-subscribe@egroups.com] to join mailing list.

Web (AARC): [http://www.qsl.net/albuquerquearc/ardf/ardf.html].

Friendship Radiosport Games
August 7–10, 2001

Postal Mail (USA team): Friendship Amateur Radio Society, P.O. Box 13344, Portland OR 97213.

Postal Mail (Canadian team): Friendship Amateur Radio Society, 3018 Spring Bay Road, Victoria BC V8N1Z3, Canada.

E-mail: [farsusa@aol.com] for USA team; [va7pc@rac.ca] for Victoria organizers.

Web (FARS-USA): [http://home.pacifier.com/~fars/].

NEVER SAY DIE

continued from page 4

Look, I'm depending on you because I feel that the whole future of the hobby is in your hands. I'm concerned that the ARRL isn't going to do anything to keep amateur radio from disappearing, and the ham industry is so disorganized that it can't do anything. Please don't wait for someone else to step up to cross-band your local repeaters. Maybe one cross-banded to 20m, one to 75m, and one for 15m? I used to have a fantastic time cross-banding 20m DX stations into my 75m roundtable contacts. Well, I had separate 20m and 75m kW stations, so it was easy to do—and it sure was exciting for everyone involved.

DNA Damage

Did you see the report from the *Journal of the National Cancer Institute* about young smokers triggering changes in their DNA which put them at a higher risk for cancer later in life? Another study showed that 4% of the 4th graders, 7% of the 5th graders, and 15% of the 6th graders had already smoked. Plus over 3 million teenagers who are already addicted to nicotine.

Well, it makes sense. Youngsters' bodies are growing at a high rate compared with adults', so even small amounts of poisons will tend to affect them more, interfering with their cells' ability to make exact DNA duplicates.

We know that mothers who smoke during pregnancy produce children with an average of 8–10 points lower IQ. And that dads who smoke before conception also contribute to an IQ loss. Well, 80 years ago, cigarettes were called coffin nails.

Never Say Die

I particularly like what Kemmons Wilson, the founder of Holiday Inn, had to say in *Imprimus*, the Hillsdale College newsletter (it's free, so subscribe — Hillsdale College, Hillsdale MI 49242). Wilson was discussing entrepreneurialism and said, "Coming up with an idea should be like sitting on a pin— it should make you jump up and do something. I've had a great many ideas over the years. Some were good, some were great, and some I would prefer to forget about. The important thing is to take your best ideas and see them through. Not all of them are going to be winners, but just remember, a person who wins success may have been counted out many times before. He wins because he refuses to give up."

And that's the same thing Ray Kroc, the guy who gave us McDonald's preached. Ray said success doesn't take brains. It doesn't take education. All it takes is perseverance. Never Say Die.

My Failure

While most of the *73* mail is complimentary about my editorials, now and then I get complaints about my not writing about ham radio exclusively. What makes all of the brickbats bearable are letters such as this one from George Daviskul of Jackson MI:

"I discovered you via Art Bell and I discovered me via you. Your information and insight on life is invaluable, and your book suggestions are treasures. You should be aware of the impact you have on people. It's all very positive. Your book suggestions will last me for years to come. I am very excited to be able to share truth. There's never enough of that. Once again, thank you."

What frustrates me is that when I send out a hundred catalogs of my books I'll get back maybe ten book orders. Rather than being happy that I've had an opportunity to touch ten lives, I can't help being disappointed that I've failed to reach the other 90.

Contests

Yes, I know how much some hams hate contests. They grumble and complain about the bands being loused up for a whole weekend or two as the ARRL runs their Sweepstakes, a DX contest, or Field Day.

Hey, guys, the reason the bands are so loused up is because thousands of hams are having fun. If you weren't such an old pill you, too, could be having a ball.

Sure, if you want to win a contest for your section you're going to have to have a pretty good station, a lot of operating savvy, and lots of stamina.

Not that it takes anything outrageous to run up a big score. I had a reasonably good signal on 20m with a kilowatt and a three-element beam. Standard stuff. The day before the contest started I hung a 75m sloping dipole from my tower so I could make some contacts on that band when 20m closed down at night.

So what happened? I ended up with one of the highest scores in the country! My 75m dipole gave me a walloping signal, complete with contacts in Alaska and Hawaii.

Heck, back in 1941 I won the Sweepstakes contest for my section just operating on 160m! I've still got the medal the League sent me pinned on my hamfest hat.

I've had a ball in DX contests. I managed to work 100 countries in one weekend on 20m SSB during one contest. Whew! I got number 100 in the closing seconds of the contest. Was it fun? I'm still bragging about it, ain't I?

If you'll look back in QST you'll see that I've won the VHF contest for my section, too.

Getting on the air from a good hot DX location is another kind of contest. The idea is to give as many stations a signal report as you can during the few days you're there, and that takes some damned good operating. The hard part is picking the call letters out of the mess. I worked out a system that no one yet has beat. I guarantee that if you go on a DXpedition somewhere you will never forget a minute of the experience for the rest of your life.

The DXpeditions where I had the most fun were to Navassa Island, in the Caribbean. I went there twice, and both times were fantastic adventures. But I've had memorable fun working the pileups from

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Wise Up!

Here are some of my books which can change your life (if you'll let 'em). If the idea of being healthy, wealthy and wise interests you, start reading. Yes, you can be all that, but only when you know the secrets which I've spent a lifetime uncovering.

......Wayne

The Bioelectrifier Handbook: This explains how to build or buy ($155) a little electrical gadget that can help clean the blood of any virus, microbe, parasite, fungus or yeast. The process was discovered by scientists at the Albert Einstein College of Medicine, quickly patented, and hushed up. It's curing AIDS, hepatitis C, and a bunch of other serious illnesses. The circuit can be built for under $20 from the instructions in the book. $10 (01)

The Secret Guide to Wisdom: This is a review of around a hundred books that will help you change your life. No, I don't sell these books. They're on a wide range of subjects and will help to make you a very interesting person. Wait'll you see some of the gems you've missed reading. $5 (02)

The Secret Guide to Wealth: Just as with health, you'll find that you have been brainwashed by "the system" into a pattern of life that will keep you from ever making much money and having the freedom to travel and do what you want. I explain how anyone can get a dream job with no college, no résumé, and even without any experience. I explain how you can get someone to happily pay you to learn what you need to know to start your own business. $5 (03)

The Secret Guide to Health: Yes, there really is a secret to regaining your health and adding 30 to 60 years of healthy living to your life. The answer is simple, but it means making some difficult lifestyle changes. Will you be skiing the slopes of Aspen with me when you're 90 or doddering around a nursing home? Or pushing up daisies? No, I'm not selling any health products. $5 (04)

My WWII Submarine Adventures: Yes, I spent from 1943-1945 on a submarine, right in the middle of the war with Japan. We almost got sunk several times, and twice I was in the right place at the right time to save the boat. What's it really like to be depth charged? And what's the daily life aboard a submarine like? How about the Amelia Earhart inside story?If you're near Mobile, please visit the Drum. $5 (10)

Wayne's Caribbean Adventures: My super budget travel stories – where I visit the hams and scuba dive most of the islands of the Caribbean. You'll love the special Liat fare which let me visit 11 countries in 21 days, diving all but one of the islands, Guadeloupe, where the hams kept me too busy with parties. $5 (12)

Cold Fusion Overview: This is both a brief history of cold fusion, which I predict will be one of the largest industries in the world in the 21st century, plus a simple explanation of how and why it works. This new field is going to generate a whole new bunch of billionaires, just as the personal computer industry did. $5 (20)

Cold Fusion Journal: They laughed when I predicted the PC industry growth in 1975. PCs are now the third largest industry in the world. The cold fusion ground floor is still wide open, but then that might mean giving up watching ball games. Sample: $10 (22).

Julian Schwinger: A Nobel laureate's talk about cold fusion—confirming its validity. $2 (24)

Improving State Government: Here are 24 ways that state governments can cut expenses enormously, while providing far better service. I explain how any government bureau or department can be gotten to cut it's expenses by at least 50% in three years and do it cooperatively and enthusiastically. I explain how, by applying a new technology, the state can make it possible to provide all needed services without having to levy *any* taxes at all! Read the book, run for your legislature, and let's get busy making this country work like its founders wanted it to. Don't leave this for "someone else" to do. $5 (30)

Mankind's Extinction Predictions: If any one of the experts who has written books predicting a soon-to-come catastrophe which will virtually wipe us all out is right, we're in trouble. In this book I explain about the various disaster scenarios, from Nostradamus, who says the poles will soon shift, wiping out 97% of mankind, to Sai Baba, who has recently warned his followers to get out of Japan and Australia before December 6th this year. The worst part of these predictions is the accuracy record of some of the experts. Will it be a pole shift, a new ice age, a massive solar flare, a comet or asteroid, a bioterrorist attack, or even Y2K? I'm getting ready, how about you? $5 (31)

Moondoggle: After reading René's book, *NASA Mooned America*, I read everything I could find on our Moon landings. I watched the videos, looked carefully at the photos, read the astronaut's biographies, and talked with some of my readers who worked for NASA. This book cites 25 good reasons I believe the whole Apollo program had to have been faked. $5 (32)

Classical Music Guide: A list of 100 CDs which will provide you with an outstanding collection of the finest classical music ever written. This is what you need to help you reduce stress. Classical music also raises youngster's IQs, helps plants grow faster, and will make you healthier. Just wait'll you hear some of Gotschalk's fabulous music! $5 (33)

The Radar Coverup: Is police radar dangerous? Ross Adey K6UI, a world authority, confirms the dangers of radio and magnetic fields. $3 (34)

Three Gatto Talks: A prize-winning teacher explains what's wrong with American schools and why our kids are not being educated. Why are Swedish youngsters, who start school at 7 years of age, leaving our kids in the dust? Our kids are intentionally being dumbed down by our school system — the least effective and most expensive in the world. $5 (35)

Aspartame: a.k.a. NutraSweet, the stuff in diet drinks, etc., can cause all kinds of serious health problems. Multiple sclerosis, for one. Read all about it, two pamphlets for a buck. (38)

One Hour CW: Using this sneaky booklet even *you* can learn the Morse Code in one hour and pass that dumb 5wpm Tech-Plus ham test. $5 (40)

Code Tape (T5): This tape will teach you the letters, numbers and punctuation you need to know if you are going on to learn the code at 13 or 20 wpm. $5 (41)

Code Tape (T13): Once you know the code for the letters (41) you can go immediately to copying 13 wpm code (using my system). This should only take two or three days. $5 (42)

Code Tape (T20): Start right out at 20 wpm and master it in a weekend. $5 (43)

Wayne Talks Not at Dayton: This is a 90-minute tape of the talk I'd have given at the Dayton, if invited. $5 (50)

Wayne Talks at Tampa: This is the talk I gave at the Tampa Global Sciences conference. I cover cold fusion, amateur radio, health, books you should read, and so on. $5 (51)

$1 Million Sales Video: The secret of how you can generate an extra million in sales using PR. This will be one of the best investments you or your business will ever make. $43 (52)

Reprints of My Editorials from *73*.

Grist I: 50 of my best non-ham oriented editorials from before 1997. $5 (71)

Grist II: 50 more choice non-ham editorials from before 1997.$5 (72)

1997 Editorials: 148 pages. 216 editorials discussing health, ideas for new businesses, exciting new books I've discovered, ways to cure our country's more serious problems, flight 800, the Oklahoma City bombing, more Moon madness, and so on. $10 (74)

1998 Editorials: 168 pages that'll give you lots of controversial things to talk about on the air. $10 (75)

1999 Editorials: 132 pages of ideas, book reviews, health, education, and anything else I think you ought to know about. $10 (76)

2000 Editorials: In the works.

Silver Wire: With two 3" pieces of heavy pure silver wire + three 9V batteries you can make a thousand dollars worth of silver colloid. What do you do with it? It does what the antibiotics do, but germs can't adapt to it. Use it to get rid of germs on food, for skin fungus, warts, and even to drink. Read some books on the uses of silver colloid, it's like magic. $15 (80)

Wayne's Bell Saver Kit. The cable and instructions enabling you to inexpensively tape Art Bell W6OBB's nightly 5-hr radio talk show. $5 (83)

NH Reform Party Keynote Speech. It wow'd 'em when I laid out plans for NH in 2020, with outstanding and lower cost schools, no state taxes at all, far better health care, a more responsive state government, etc. $1 (85)

Stuff I didn't write, but you need:

NASA Mooned America: René makes an air-tight case that NASA faked the Moon landings. This book will convince even you. $25 (90)

Last Skeptic of Science: This is René's book where he debunks a bunch of accepted scientific beliefs – such as the ice ages, the Earth being a magnet, the Moon causing the tides, and etc. $25 (91)

Dark Moon: 568 pages of carefully researched proof that the Apollo Moon landings were a hoax. This is a capping blow for René's skeptics. $35 (92)

Radio Bookshop

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Address ______________________________

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Use the numbers in the brackets or copy page and mark the books you want. Add $3 s/h per total order in US ($5 priority mail). $6Can. $10 foreign. ____________

Order total: US$__________ Phone (for CC orders) ____________

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☐ I need some industrial strength stress reduction so send me your Adventures In Music CD catalog

Allow 4 weeks for delivery except foreign, though we try to get most orders shipped in a day or two.

Barter 'n' Buy

Turn your old ham and computer gear into cash now. Sure, you can wait for a hamfest to try and dump It, but you know you'll get a far more realistic price if you have it out where 100,000 active ham potential buyers can see it, rather than the few hundred local hams who come by a flea market table. Check your attic, garage, cellar and closet shelves and get cash for your ham and computer gear before it's too old to sell. You know you're not going to use It again, so why leave it for your widow to throw out? That stuff isn't getting any younger!
The *73* Flea Market, Barter 'n' Buy, costs you peanuts (almost)— comes to 35 cents a word for individual (noncommercial!) ads and $1.00 a word for commercial ads. Don't plan on telling a long story. Use abbreviations, cram it in. But be honest. There are plenty of hams who love to fix things, so if it doesn't work, say so.
Make your list, count the words, including your call, address and phone number. Include a check or your credit card number and expiration. If you're placing a commercial ad, include an additional phone number, separate from your ad.
This is a monthly magazine, not a daily newspaper, so figure a couple months before the action starts; then be prepared. If you get too many calls, you priced it low. If you don't get many calls, too high.
So get busy. Blow the dust off, check everything out, make sure it still works right and maybe you can help make a ham newcomer or retired old timer happy with that rig you're not using now. Or you might get busy on your computer and put together a list of small gear/parts to send to those interested?

Send your ads and payment to: *73 Magazine*, Barter 'n' Buy, 70 Hancock Rd., Peterborough NH 03458 and get set for the phone calls. The deadline for the April 2001 classified ad section is February 10, 2001.

NEVER SAY DIE

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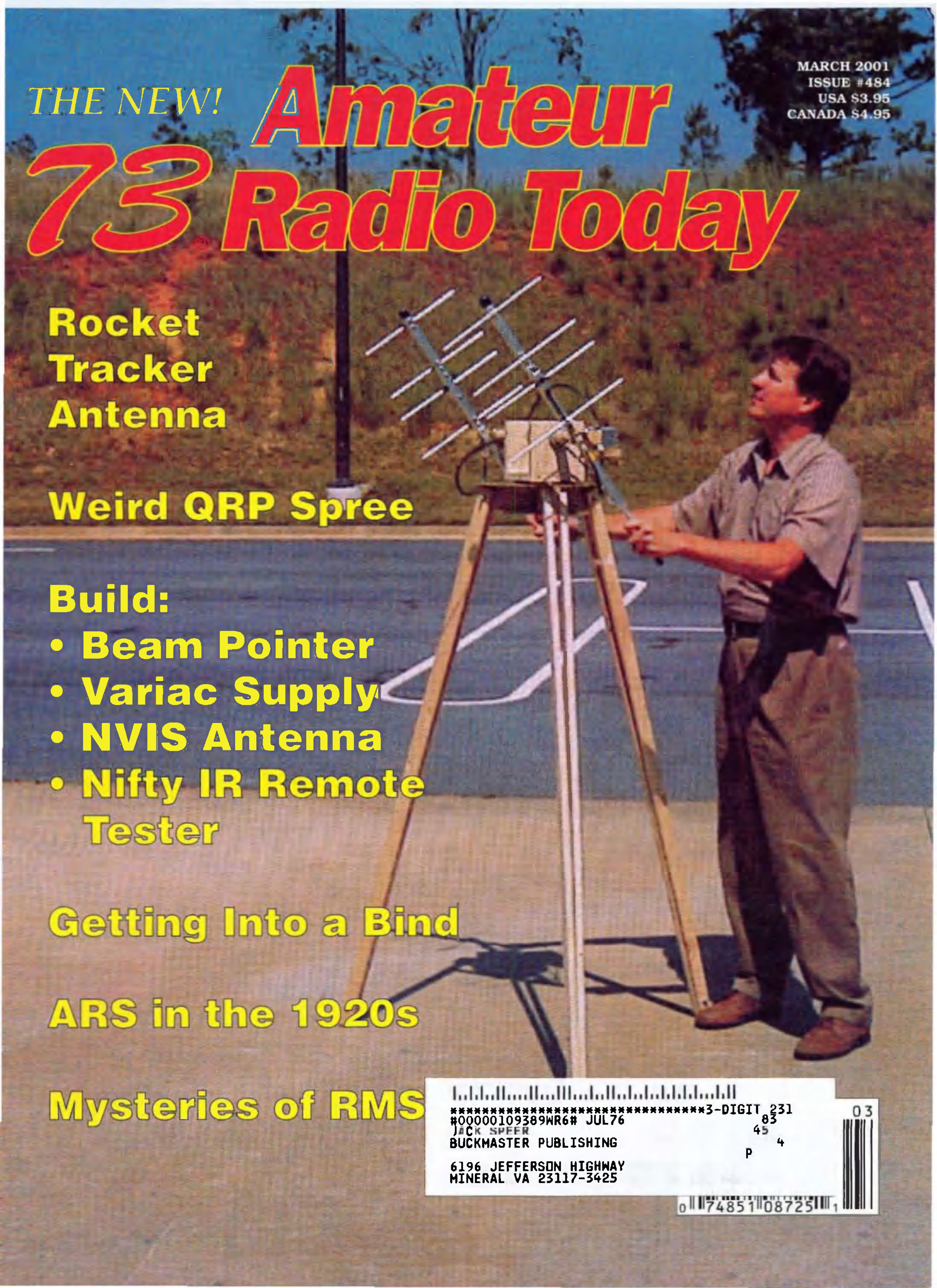
places like Nepal, Lesotho, Swaziland, Afghanistan, Sabah, Jordan, and so on. Every place I've operated from was a contest and tremendous fun, so don't grumble to me about contests lousing up the bands for a weekend. Take off your curmudgeon hat and join in the fun. Let's see how good your station is. Let's see how good an operator you are. Hey, and no lying about your power, either. I once published an article about W1FZJ Sam Harris' 100-watt contest finals, complete with a photo. He had separate 250-TH finals for every band and humongous antennas. It took a solid copper bar across his final plate meters to bring the indicated power down to the 100-watt level so he could get that multiplier.

So, what are you going to do instead of joining a contest? Rag chew? About what? When is the last time you've had a really interesting rag chew? Sorry, Charlie, but most rag chews are about as interesting as chewing a real rag.



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THE TEAM

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QRX . . .

ARISS

There's a bright new star in the sky. The International Space Station is up and running, and so is the ARISS amateur radio station on board.

While solar wings were being deployed and brought on line to provide power to the station, the international team that set up ARISS met at NASA's Goddard Space Flight Center to pin down rules and regulations and set up the plans for operating the station now and into the future.

Delegates from the United States and Russia were joined by their counterparts representing a consortium of European nations, Canada, and Japan. They elected Frank Bauer KA3HDO to chair the Administrative Group for the next two years. That's the

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NEVER SAY DIE

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Dayton 2001

In cleaning out my files for the new century, I ran across a four-year-old letter from a Dayton Hamvention assistant chairman asking for suggestions. Of course I offered a bunch. Far's I know, none of 'em were ever implemented.

For instance, I suggested they do a survey of their attendees to find out what they enjoyed the most and liked the least about the Hamvention — just as manufacturers survey customers on their products. Did they attend any talks? How would they rate them? What did they buy? About how much did they spend? A survey of the exhibitors would ask what they liked best and what least, and how the Hamvention might be made better for them. How did they do? The flea market exhibitors should also be surveyed.

These surveys would enable the convention committee to improve the product, plus give 'em added ammunition to convince more companies to exhibit.

I suggested that the Hamvention could be used as a sales pitch for the hobby — promoting their show in the local newspapers, TV, and radio shows, aimed at youngsters, and encouraging local ham groups to set up displays which would demonstrate our various special interests such as repeaters, DXing, slow-scan, packet, hamsats, and so on. We've got a ton of excitement and adventure to sell, but we've been keeping it a secret.

How about several tethered balloon rides so attendees could take pictures from two or three hundred feet up?

Most of the ham superstars have died recently — Barry Goldwater, Jean Shepherd, King Hussein — but how about getting Art Bell to give a talk? How about Walter Cronkite?

Something needs to be done by committees to make their hamfests more exciting so they'll be better attended. PR takes work but, unlike advertising, it's free. Where I've been asked to give hamfest talks I've offered to get there a couple of days early and help with radio and TV talk shows. Having been a radio DJ and a TV producer-director, I have no problem with these media. You can get a free sample by listening to archive recordings of my guest appearances on the Coast To Coast AM radio show via [www.coasttocoastam.com] and Real Audio.

Hamfests and ham conventions have to be kept in tune with the times, like any other product or service. Alas, in my experience, hamfests have changed little in the last 60 years.

Transfusions

Doctors are doing millions of blood transfusions every year, and I'll bet you're completely convinced that this is a good, lifesaving procedure. My advice? Do everything you can to avoid one!

I used to work in an office on 43rd Street in Manhattan. On the floor below our publishing offices was a blood bank, so I got a good look at their clientele over the five years I worked there — and it was mostly homeless winos, getting enough money for another bottle of the cheapest wine they could find.

As I've mentioned, every cell in your body, and that includes every cell in your blood, is in constant contact with every other cell, even when separated from you by thousands of miles. When you get a transfusion of someone else's blood, you're getting a part of them integrated into your mind/body system, and not just your body. You'll also get a good collection of any poisons they were carrying around, such as alcohol, nicotine, caffeine, and any other drugs, viruses, microbes, parasites, fungi, or yeasts in their blood. And maybe some toxic metals, too.

If you think I'm exaggerating, you haven't bothered to read *The Secret Life of Your Cells* yet. I've reviewed it in my editorial, and in my *Secret Guide to Wisdom.*

Even though the new blood is the same type as yours, it is from another person and your immune system will get busy eliminating the invader. That's just what you need at a time when you need all of the strength your immune system can muster to help you recover from whatever caused the doctors to give you the transfusion.

If you have made any effort to develop your psychic ability, once you've had a transfusion you'll be able to pick up many of the thoughts and feelings of the person from whom you've received the blood. One woman wrote a book about an organ transplant where she was able to sense the name of the donor and feel his feelings. And thousands of people have reported weird things resulting from blood transfusions. A recent lab test with cells from an athlete's heart beat exactly in pace with his heart as he walked and ran, even though he was miles away.

School Report

In Virginia, reformers, in an effort to improve their schools, required that at least 70% of the students pass the state exams or a school would lose its accreditation. When only 7% passed the exams, the requirement was quietly thrown out.

In Arizona, its requirements were withdrawn when only 10% of high school sophomores passed a new math exam. And Wisconsin had to cancel a test students were supposed to pass before they could graduate.

Our public schools are getting worse and worser.

The education establishment is being run by educators who don't know how to educate, and teachers who don't know how or what to teach. As long as schoolteachers and administrators are coming from the bottom 20% of high school students, have union-guaranteed tenure, and pay that has no connection to their performance, nothing is going to change — other than our kids are going to continue to get poorer and poorer educations.

This is a cancer which is slowly making America less and less competitive in a world where lowering communications

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group that runs ARISS. Frank will be joined by Gaston Bertels ON4WF as Vice Chair and Rosalie White K1STO as Secretary-Treasurer. Those names should sound familiar. Frank is a Vice President of AMSAT and Rosalie is an executive at the ARRL; both were key players in SAREX, the Space Amateur Radio Experiment that led to the formation of ARISS.

In final, approved form, the ARISS station will continue on the air with the present equipment and antenna in the FGB section of ISS *Alpha.* The crew currently is using voice on 2 meters. They plan to fire up packet operation in the next week or so.

Frequencies for public contacts are 145.800 packet and voice downlink and 145.990 packet uplink. Other uplinks can be found in the ARISS Web page. Call letters are NA1SS and RZ3DZR. The Russians are trying to change the latter to RSØISS.

Russia's Chief Delegate, Sergej Samburov RV3DR, was given approval to send up another station next spring, using upgraded *MIR* hardware to be installed in the Service Module. Slow Scan TV, being developed in the U.S. by a team led by Miles Mann WF1F, with hardware support from Lou McFadin W5DID, also should be activated at that time.

Future plans involving the Habitation Module and a remote station in an Express Pallet on the outside of the ISS were channeled to member nations for processing and evolution.

There was much discussion of school contacts and third-party traffic. It was agreed that this is one of the most important aspects of ARISS. The first school contact was to be set up as soon as possible. ARISS hopes that the astronauts'/cosmonauts' busy schedule may accommodate a school contact a week, once the station settles into routine operation.

The delegates even agreed on a QSL card. It's a beauty, complete with a cover picture of the International Space Station, the permanent home in space for amateur radio.

Thanks to Roy Neal K6DUE, via Newsline, *Bill Pasternak WA6ITF, editor.*

Eye in the Sky: Your QTH from Space

Ever wonder what your home QTH would look like if you were trying to view it from Earth orbit? Well, now you can find out without ever leaving your hamshack, if it has a connection to the Internet.

All you have to do is take your Web browser over to [www.globexplorer.com]. Globexplorer is one word. Then click in the word explore and enter your complete address in the area provided. Click the go button, and in less than a minute you will be looking at your neighborhood from space. And if you are not satisfied with what you see, you can zoom in or slew the picture in just about any direction. And some of the photos are so good that large antenna systems are visible.

Thanks to Jim Damron N8TMW, via Newsline, *Bill Pasternak WA6ITF, editor.*

FAR Scholarships

The Foundation for Amateur Radio, Inc., a nonprofit organization with headquarters in Washington, DC, plans to administer 67 scholarships for the academic year 2001–2002 to assist licensed radio amateurs. The Foundation, composed of over 75 local area amateur radio clubs, fully funds 10 of these scholarships with the income from grants and its annual hamfest. The remaining 57 are administered by the Foundation without cost to the various donors.

Licensed radio amateurs may compete for these awards if they plan to pursue a full-time course of studies beyond high school and are enrolled in or have been accepted for enrollment at an accredited university, college, or technical school. The awards range from $500 to $2,500 with preference given in some cases to residents of specified geographical areas or the pursuit of certain study programs. Clubs, especially those in Delaware, Florida, Maryland, Ohio, Pennsylvania, Texas, Virginia, and Wisconsin, are encouraged to announce these opportunities at their meetings, in their club newsletters, during training classes, on their nets, and on their World Wide Web home pages.

Additional information and an application form may be requested by letter or QSL card, postmarked prior to April 30, 2001, from FAR Scholarships, P.O. Box 831, Riverdale MD 20738.

The Foundation for Amateur Radio, incorporated in the District of Columbia, is an exempt organization under Section 501(C)(3) of the Internal Revenue Code of 1954. It is devoted exclusively to promoting the interests of amateur radio and those scientific, literary, and educational pursuits that advance the purposes of the Amateur Radio Service.

Thanks to FAR for this news item as well as all their efforts.

The Many Lives of Iridium

Motorola's seemingly doomed constellation of Iridium low Earth orbiting telecommunications satellites has gotten a new lease on life. This, as the U.S. Department of Defense signs a two year 72 million dollar contract with the newly formed Iridium Satellite LLC to keep the satellites in orbit and functional.

Under the agreement, Iridium Satellite has contracted with Boeing to take over operation of the 66-satellite cluster from Motorola. Iridium Satellite LLC will then market their services to commercial users as well as to the U.S. military and other government users. The State Department already owns 2,000 Iridium handsets for use in remote spots on humanitarian missions.

Thanks to Newsline, *Bill Pasternak WA6ITF, editor.*

Ham-Palm

Thanks to Jeff Davis N9AVG, you can now catch up on the latest ham radio news over your PalmPilot. All you need do is visit [www.callingcq.org] and subscribe to the new AvantGO channel titled "CALLING CQ." Then, each time you sync your Palm OS or Win CE device, you'll receive the most comprehensive news and information available for amateur radio enthusiasts.

Thanks to N9AVG, via Newsline, *Bill Pasternak WA6ITF, editor.*

DARA Scholarships

The Dayton Amateur Radio Association is now accepting requests for their annual scholarships. These scholarships are awarded in varying amounts up to $2,000. An applicant for a DARA scholarship must be a graduating high school senior in 2001 and must also hold a valid United States–issued FCC amateur license. To find out more or obtain an application, please send a self-addressed stamped envelope to DARA Scholarships, 45 Cinnamon Court, Springboro OH 45066. Completed applications must be postmarked no later than June 1st, 2001.

Thanks to DARA, via Newsline, *Bill Pasternak WA6ITF, editor.*

CQ de CQ2KK

On the international scene, famed Cuban VHF DXer and *CQ Magazine* writer Arnie Coro CO2KK continues to host a radio program called CQ DX Unlimited. Arnie's show is broadcast in English over Radio Havana Cuba and is aimed mainly at shortwave listeners and beginners in amateur radio. CQ DX Unlimited is broadcast on Tuesdays at 2115 to 2130 UTC on 13.750 MHz AM and on 13.660 MHz SSB. Be sure to listen in.

Thanks to G4NJH, via Newsline, *Bill Pasternak WA6ITF, editor.*

Ham Radio History Remailer

The Ham Radio History E-mail reflector was founded in September of 1998 in an effort to research and preserve as much of ham radio's past

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and transportation costs are moving hundreds of thousands of jobs to lower-wage countries, which provide far-better-educated workforces.

The teachers' unions have rejected every effort to even test the teaching systems which have been producing amazing results in some experimental schools. Hmm, why does that remind me of the medical establishment refusing to allow tests of therapies which have been shown to have great promise?

But, hey, as long as you don't care what the schools are doing to your kids, nothing is going to change. No, there will be change, but it will be, as in the past, change for the worse.

Rome distracted its citizens with games while their civilization was crumbling. We're busy with ball games, TV talk shows, and the political rhetoric of election campaigns. Let's get more Christians and lions into the arenas.

Maybe you read about the dozens of New York City teachers and principals who were found to be helping students to cheat on tests in order to make their schools look better?

Yes, More Aspartame News

One young woman had been paralyzed from the waist down by a car accident. But as a regular drinker of "Diet Coke" or Pepsi with aspartame (NutraSweet) in it, she was soon paralyzed from the neck down. Then there was a young boy who had become brain damaged by diet sodas containing aspartame. Not everyone becomes brain damaged or semi-paralyzed to the extent that it's immediately and dramatically noticeable — we all have different susceptibilities, different detoxing capabilities — but why knowingly put a proven poison in your body? We unknowingly put in enough as it is. The damage can well be cumulative and show up later.

Boners

Our politicians have pulled some incredible boners during the 20th century. Like what? Like rent control, for instance. This socialist dream has done more to ruin cities than poverty or drugs. It's destroyed much of the Bronx, Paris, and other cities around the world. The president of Vietnam said that low rents had done more damage to Hanoi than all of the American bombing.

Like price controls, which in every instance have resulted in prices skyrocketing. When manufacturers find their profits on a product are falling, they "improve" the product and bring it out at a higher price.

Like prohibition, which brought us the Mafia and organized crime, which is flourishing just fine today, thank you, and in all sorts of businesses. I found them a controlling force in newsstand distribution and making sure the bigger radio stations only played the music of the major labels.

Then there's the so-called War on Poverty. What a joke. And the War on Drugs, which has built a new group of wealthy criminals, plus billions for the bribery of tens of thousands of police, attorneys, judges, and customs agents.

I'm open for your nominations for other worst ideas of the 20th century. Get your word processor going and snail- or E-mail me at w2nsd @aol.com.

Buying Radios

If you or a friend are in the market for a shortwave receiver, you want to make an educated buy, so you won't get hornswoggled. There seems to be an unlimited supply of hornswogglers, so you need to approach the situation not too information-challenged.

I don't know about you, but I keep a radio which includes shortwave coverage at my bedside, so I can check out a couple of the more interesting shortwave stations, check the CHU time ticks, and see who Coast-To-Coast AM has on for a guest. My instrument of choice for this is the Sony ICF-SW1. It's 3x5x1 inches, weighs a half a pound, and covers BC-SW-FM — 150–30,000 kHz, 76–108 MHz. Of course, it goes with me on trips.

So, when you're shopping the flea markets, the ham rag classifieds, or the WWW, you need Fred Osterman's N8EKU *Buying a Used Shortwave Receiver* book. It's $6 (+$2 s/h), 78 pages, and gives a description of 100 of the most popular radios, complete with used prices. If you can't find the book at your local radio store, write Universal Radio, 6830 Americana Pkwy, Reynoldsburg OH 43068. You might even splurge another $2 for their 108-page catalog. It's a beaut.

Prayer Works

Yep, they've double-blind-proven it scientifically. Read Robert Miller's *Miracles In The Making*, Ariel Press, 289 South Main Street #205, Alpharetta GA 30201, 128pp., $10. I watched a video of one of the experiments described in this book at a Subtle Energies conference in Monterey (CA). That's where Olga Worrall, the noted psychic, lowered the surface tension of a jar of water just by putting her hands near it. Then, she was shown repeating this from over a thousand miles away while the camera ran.

This book is packed with the proof of prayer's power. In one experiment with a large group of people with high blood pressure, psychics were able to pray for half of them and substantially lower their blood pressure. No one in the group knew which of them were being prayed for and which weren't, so it wasn't any placebo effect.

I've reviewed several other books which prove that just wishing for something can make it happen, so this proof of the power of prayer isn't a big stretch.

This takes me back to Neil Slade's book, where he explains how simple it is to manipulate clouds with your mind. You don't have to pray to God, to Jesus, to Allah, or to Mohammed. And it works just as well for atheists as the devout of any commercial religion.

My Books

I hope you'll read my *Secret Guide to Health* and start changing your lifestyle so you'll be able to enjoy robust health. Then I hope that you'll do your best to get the word to people you care about, so they can regain their health. My editorials in *73* are a tiny lever, but with your help we can make thousands, and then millions of people healthier and wealthier. This business of spending a lifetime working at jobs — being a "worker" — is just one more way we've all been bamboozled. Send an SASE for a catalog of my publications to Wayne Green, Hancock NH 03449.

We Wuz Robbed

Several of the books reviewed in my *Secret Guide to Wisdom* have to do with how bad our school system is, and how it got that way. In my "spare time" (har-de-har) I've been working on a book which has as its core my editorial essays on the subject, plus relevant material from my now-sold-out *Declare War!* book.

Our school system is both by far the most expensive in the world, and the worst, at least in the developed world. Our kids come in at the bottom on international tests.

I've complained that one result of this dumbing down process has been a lack of geniuses. I've noticed this particularly in the music field. When I turn to a classical music station I know almost immediately who the composer is, even if I'm not familiar with the piece. Beethoven, Wagner, Copland, and so on, all have their stamp on their music. It turns out that I'm not the only person to notice this phenomenon.

Continued on page 62

David Babulski N4XVF
2677 Colony Circle
Snellville GA 30078

Way Cool Rocket Project: Part 2

This 70cm rocketborne radio telemetry system is strictly for kids — NOT!

Part one of this series described the construction of a 433 MHz telemetry transmitter and receiver. Part two will describe construction of a 433 MHz telemetry receiving antenna and integration of the telemetry transmitter into the rocket payload section. Let's begin with construction of the telemetry receive antenna.

The telemetry receive antenna consists of two Astron Corporation Model 400-4 yagi antenna kits cut for 433 MHz operation, stacked vertically, and fed in phase. The Astron Model 400-4 kit can be purchased directly from Astron Corporation or from Ramsey Electronics as Ramsey #400-4. Specifications for the 4-element yagi indicate a forward gain of 7 dB, with a half-power beamwidth of about 30 degrees. With two antennas stacked for vertical polarization and fed in phase, the forward gain becomes 9.5 dB, with the vertical half power beamwidth reduced to about 15 degrees. In addition, the vertical capture area of the antenna is doubled. With only 80 milliwatts from the transmitter, we need all the gain and capture area that we can get to ensure solid copy of the telemetry signal. Vertical polarization of the receive antennas was selected to match the vertical polarization of the rocket-mounted transmit antenna. Because the rocket is in motion, the receive antenna must be able to follow the flight path to ensure positive reception of telemetry data. To accomplish this I created a fully steerable alt-azimuth antenna mount. **Photo A** shows the completed antenna array in tracking mode.

Photo A. Completed antenna array in tracking mode.

Building the antenna array begins with construction of the two 4-element yagi antennas. The Astron Model 400-4 is supplied as an undrilled aluminum boom with four sets of aluminum element material. (The driven element is preassembled but not cut to length.) Element mounting hardware is also supplied. Each element must be cut for the operating frequency. A chart is supplied with the kit that gives element dimensions and element spacing for specific frequencies. In addition to drilling the boom for the antenna elements, the boom must also be drilled for the mounting hardware and for an antenna counterweight. **Fig. 1** is a drawing of the antenna dimensions that I used in building the yagis for 433 MHz.

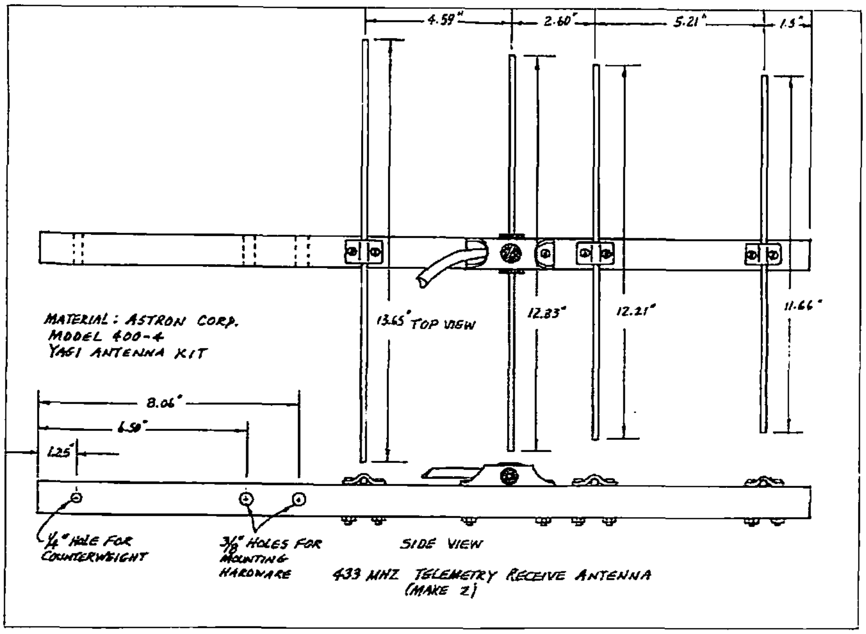

Fig. 1. Tracking antenna.

The antenna counterweights are 6-inch lengths of 1/2-inch-diameter soft steel rod. The counterweights are installed after the antennas are assembled and mounted. As a safety measure, these counterweight rods are wrapped with fluorescent red tape to prevent them being an eye hazard. Now that you have the two antennas assembled and drilled, set them aside and begin construction on the antenna mount.

The antenna mount

Three sub-assemblies are combined together to form the antenna mount. These three subassemblies are the tripod legs, tripod head, and elevation bearing box and azimuth bearing.

The tripod legs and tripod head are built first. **Fig. 2** is a dimensioned drawing of the tripod parts.

Cut six lengths of 1-1/2- x 3/4-inch clear pine to sixty inches (5 ft.). Each

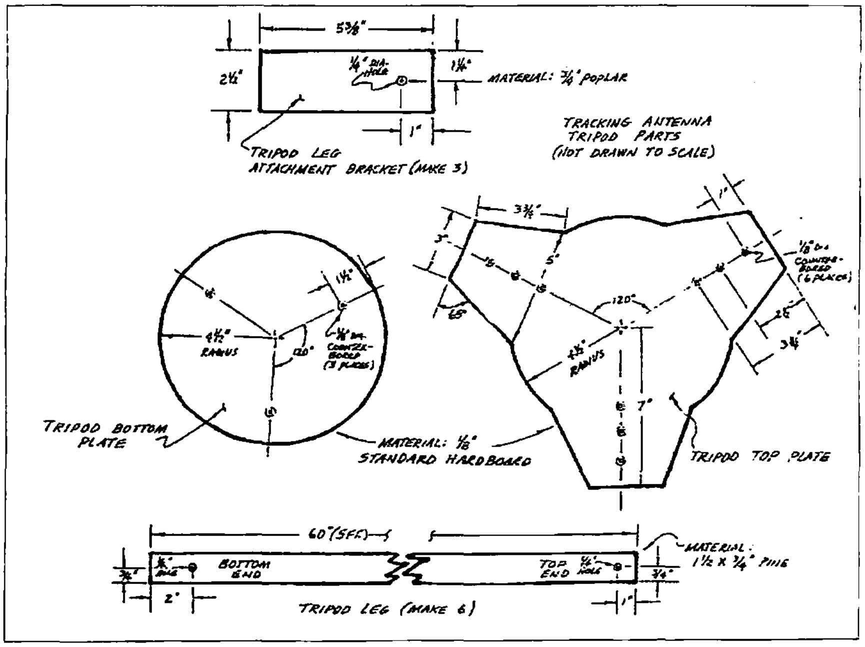

Fig. 2. Tracking antenna tripod parts.

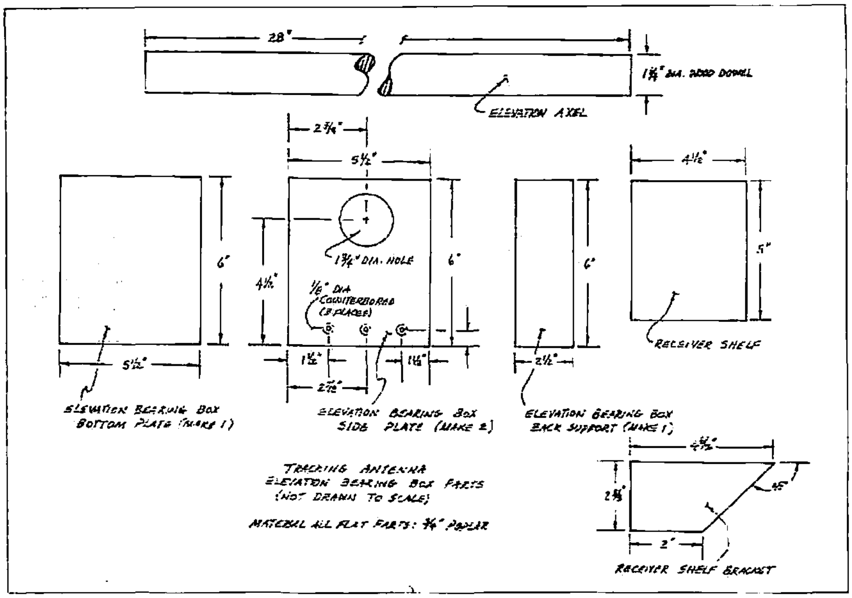

Fig. 3. Tracking antenna elevation bearing box parts.

tripod leg is made up of two of these five-foot members. Using the dimensioned drawing as a guide, mark the locations of the 1/4-inch holes on each end of the legs. Drill 1/4-inch holes at the top and bottom ends of each tripod leg at the measured locations. Fasten the bottom two members of each leg together with a 1/4-inch x 3-inch bolt. Loosely fasten the nut on each of the three bolts.

I elected to use 1/8-inch-thick standard hardboard as the material for the top and bottom plates on the tripod head. This material is inexpensive and easily worked. You can find this material at most home improvement centers. Once the top and bottom plates are cut to shape, use the dimensioned drawing to mark locations for the screw holes. Using a drill and a 1/8-inch drill bit, drill the nine screw holes in the tripod top plate and the three screw holes in the tripod bottom plate. Use a countersink bit to slightly counter bore these screw holes. This will ensure that the flathead wood screws to be used later will rest flat with the surface of the top and bottom plates.

Photo B. Elevation bearing box, rear view.

The next step is to cut the tripod leg attachment brackets from 3/4-inch poplar stock. Use a drill and a 1/4-inch drill bit to drill the holes for the leg attachment bolts, as indicated on the plan. Next, place the tripod leg attachment brackets in line with the screw holes in the top plate. Use an ice pick or small nail to mark the screw hole locations on the leg brackets. Use a drill and a 1/16-inch bit to drill screw pilot holes in the leg brackets. Fasten the leg brackets to the tripod top plate with wood glue and flathead wood screws.

Turn the tripod over, center the bottom plate, and line up the screw holes with the leg brackets. Mark the screw hole locations on the leg brackets and drill the 1/16-inch screw pilot holes. Use wood glue and flathead wood screws to fasten the bottom plate to the tripod leg brackets. Set this assembly aside to dry.

The elevation bearing box is the next component of the antenna mount. **Fig. 3** is a dimensioned drawing of the parts for the elevation bearing box.

Start by cutting all the pieces for the bearing box. Make sure to make two of the side plates. I used 3/4-inch poplar for the bearing box, although the type of material is not critical. Mark and drill the holes in the side plates using information from the plans. Fasten the bearing box side plates to the bottom plate with wood screws and wood glue. Slide the elevation bearing box back support in place and secure with wood glue. **Photo B** shows the backside of the elevation bearing box, and the relationship between all the parts.

The receiver shelf and shelf bracket are fastened to the back of the elevation bearing box with epoxy. Cut a length of 1-1/4-inch-diameter hardwood dowel to 28 inches. This will become the elevation axle. The azimuth bearing is a Shepherd Hardware Products Model 9548 ball bearing lazy Susan. Fasten the lazy Susan to the bottom of the elevation bearing box with small flathead wood screws. Position the elevation bearing box in the center of the tripod top plate. Rotate the box so that the mounting holes for the lazy Susan are visible. Mark position of the lazy Susan mounting holes

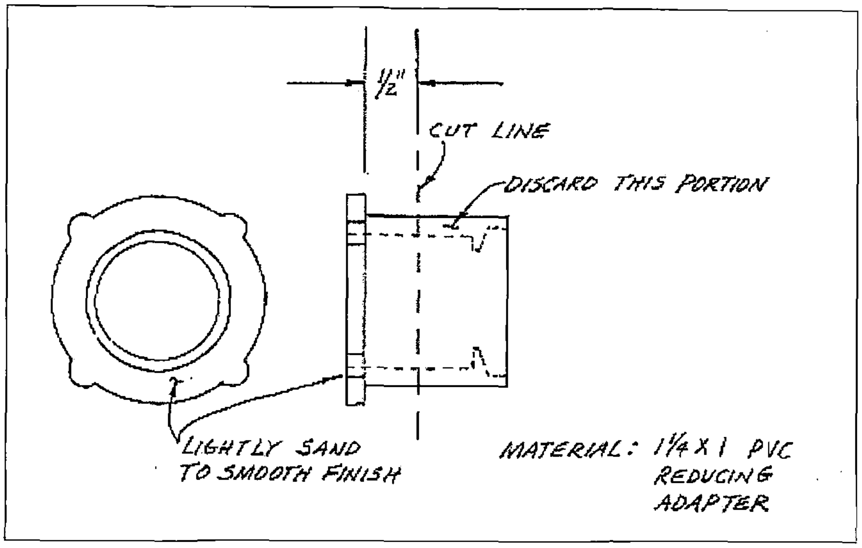

Fig. 4. Elevation bearing detail.

on the tripod top plate. You will find that one of the four lazy Susan mounting holes will line up with the position of a tripod leg bracket. A flathead wood screw should be used at this position. The remaining three mounting holes will use 6-32 x 1-inch machine screws and nuts.

Modified 1-1/4- x 1-inch PVC reducer adapters are used as bearings for the elevation axle. **Fig. 4** is a drawing showing the modifications of the PVC adapters. You will need to make four of the modified adapters.

As shown in **Fig. 4**, the shank of each PVC adapter is cut down to a length of 1/2-inch. Make sure to remove any burrs with a small knife. The outside diameter of the PVC adapter is a little less than the 1-3/4-inch-diameter hole. Take two of the cut-down adapters and wrap masking tape around the outside surface of the 1/2-inch-long shank until it just fits into the 1-3/4-inch-diameter hole in the elevation bearing box side plate. Coat the inside surface of the 1-3/4-inch-diameter hole and the outside surface of the tape on the adapter with 5-minute epoxy and fit in place. Use care to not get any of the epoxy on the inside surface of the adapter. After the epoxy has set, slide the elevation axle into the PVC adapter bearings and center it with respect to the elevation bearing box. Slide one of the remaining prepared PVC adapters over one end of the elevation axle and bring up tight to the mounted bearing. Refer to **Photo B** to see this relationship between the bearing surfaces. While holding the prepared PVC adapter in place, use a drill and a 3/16-inch drill bit and drill through the PVC adapter and the axle. Slide a 5/32 x 2-1/2-inch cotter pin into the hole to hold the bearing in place. Repeat this procedure on the other end of the elevation axle. At this point, attach the leg assemblies to the leg brackets with 4-inch x 1/4-inch carriage bolts and nuts. Spread the tripod legs out so that the elevation bearing box is at a comfortable working height. The next step is to mount the antennas to the elevation axle.

Mounting the antennas

Radio Shack #15-826 U-bolt and clamp assemblies are used to mount the prepared antennas to the elevation axle. **Photo C** shows how the antenna is mounted to the elevation axle.

Make sure the driven element is directed outward (as shown in the photograph) and that the element is aligned with the end of the elevation axle. This will ensure proper spacing of the two antennas. Next, move the antennas so the booms are horizontal and insert the previously prepared lengths of steel rod into the rear open end of the boom. Adjust position of the steel rods until the antennas are balanced on the elevation axle. Mark this position on the

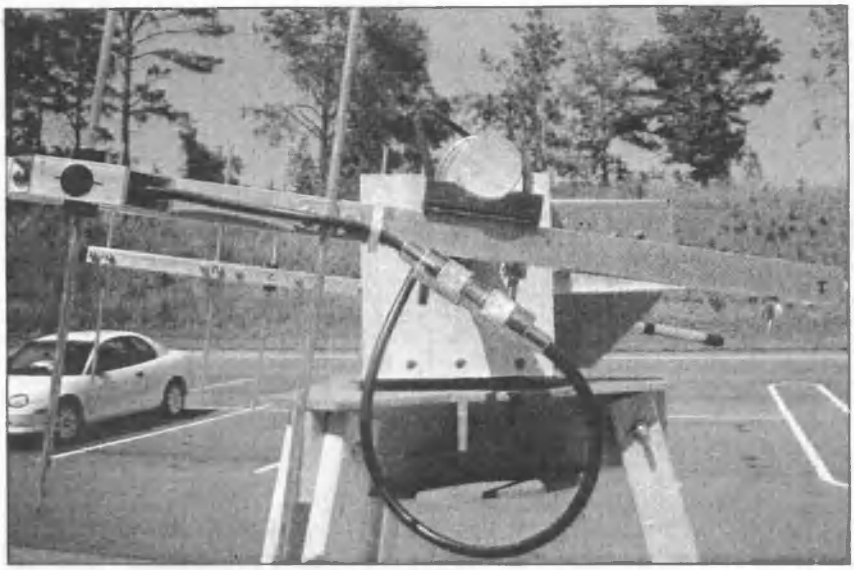

Photo C. Antenna mounted to elevation axle.

steel rod through the hole in the end of the antenna boom. Use a drill and 1/4-inch drill bit to drill a mounting hole through each of the steel rods at the marked locations. Install the steel rods into the rear end of the antenna booms with a 1/4-inch x 2-inch bolt and wing nut. The remaining step in antenna construction is fabrication of the coaxial cable phasing harness.

Building the phasing harness

Fig. 5 is a dimensioned drawing of the coaxial phasing harness.

The harness uses two sections of RG-6 75-ohm coax, each leg 37 inches in length. The first step, however is to attach a connector to the short length of coax from the antenna driven element. Cut this length of coax to 6 inches and attach a male coaxial connector. A coaxial barrel connector is used to join the phasing harness to each of the driven element connectors.

The photographs in this article show the details of mounting the phasing harness. This completes construction of the telemetry receive antenna array.

Integration of the telemetry transmitter into the rocket payload section

IMPORTANT NOTE: The rocket kit described in this project is NOT designed for those who are beginners to rocketry. If you are new to this discipline, I recommend that you contact the National Association of Rocketry or the Tripoli Rocketry Association (addresses at the end of this article) for the location of a rocketry club close to your area. Members of these organizations are eager to offer help to those new to rocketry.

The rocket airframe used in this project is the Vaughn Brothers Extreme 38 rocket kit. Construction of the rocket airframe is outside of the scope of this article. The kit should be built according to the instructions supplied with the kit with the exceptions detailed below. **Fig. 6** is a dimensioned drawing highlighting the modifications made to the payload section of the rocket kit.

The first modification to be made is to the nose cone. As detailed in **Fig. 6**, the rear portion of the nose cone is removed and discarded. With a 1/16-inch drill bit, drill two small holes 1/2-inch from the shoulder of the nose cone. This is the point at which the thermistor will be mounted. Insert the thermistor leads into the two small holes in the nose cone. Ensure a 1/32-inch air gap between the bottom of the thermistor and the nose cone surface. Place a small dab of epoxy over the thermistor leads on the inside of the nose cone to fix the thermistor in place.

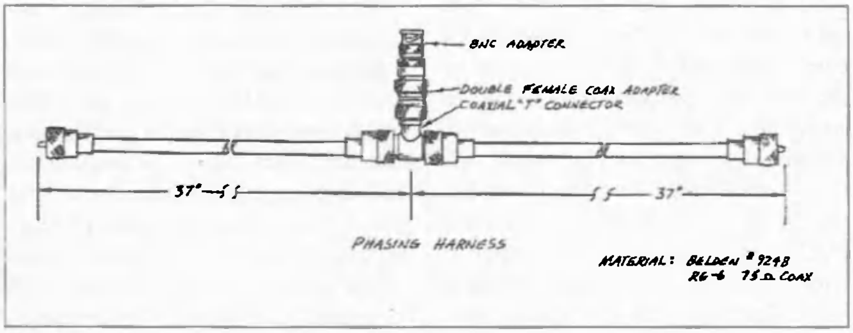

Fig. 5. Phasing harness.

Use the drawing in **Fig. 6** as a guide, and cut the thermistor shroud from a small sheet of .005-inch brass. Prepare three one-inch lengths of tinned number 22 solid copper wire. Solder these three wires to the brass shroud as shown in **Fig. 6**. Temporarily bend these wires out from the shroud and form the shroud over the thermistor. Make sure that the brass shroud will not touch the thermistor. Mark the three locations where the bent out wires touch the nose cone surface. Use a 1/32-inch drill bit to drill holes at the marked locations on the nose cone. Bend the shroud wires so they are pointing down and away from the shroud. Insert the shroud wires into the three holes. Bend the wires down from the inside of the nose cone to hold the shroud in place. Fix each shroud wire in place with a small dab of epoxy over each wire. Lay in an epoxy fillet at the shroud nose cone boundary. The shroud is used both to shield the thermistor from the sun and to protect it from flight-generated aerodynamic forces.

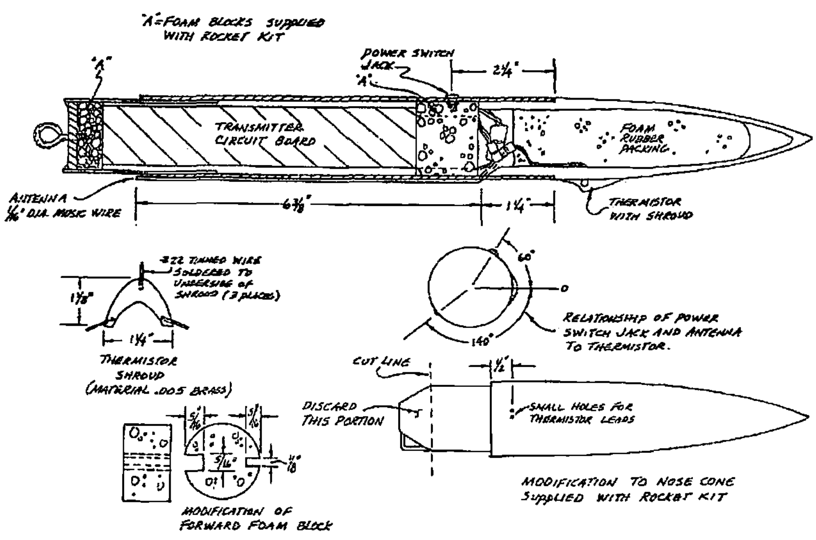

Fig. 6. Rocket assembly.

Prepare two lengths of stranded hookup wire, each 3 inches in length. Twist the two wires together. Solder a 2-pin Dean's connector to one end of the prepared two wires. Solder the free end of the wires to the thermistor leads inside the nose cone.

The Vaughn Brothers rocket kit is supplied with a mounting bracket and plate for an altimeter circuit. You will

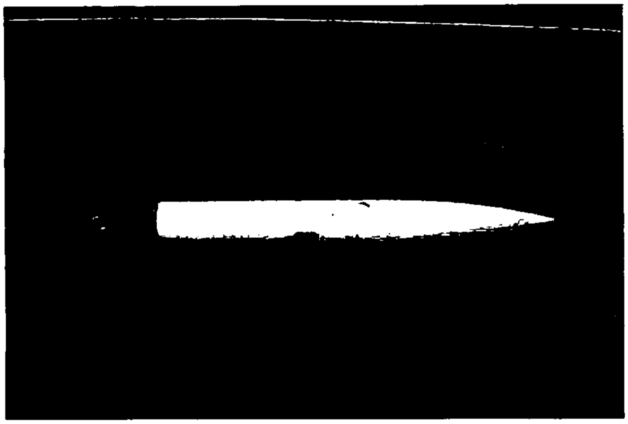

***Photo D.** Payload section, with arming jack in place.*

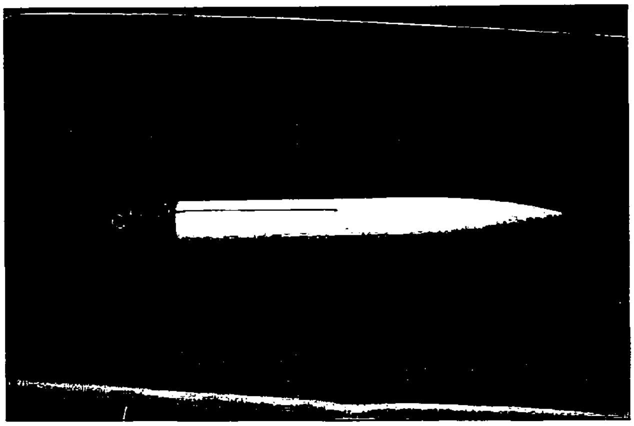

***Photo E.** Transmit antenna installed on the payload section.*

not use the metal plate. Two circular foam blocks are supplied in the kit. Use a razor saw and cut one of the foam blocks in half. Modify the remaining foam block as shown in **Fig. 6**.

Build the payload section as detailed in the rocket kit instructions. When all the epoxy adhesive has fully set, push the one-half foam block you cut earlier to the bottom of the payload section. Measure 2-1/4 inches from the front edge of the payload section and mark the position of the mounting hole for the arming jack. Use the sharp point of a modeling knife to cut a 3/16-inch-diameter hole at the point marked for the arming jack. To make installation of the transmitter easier, I placed a two-conductor connector in series with the wires from the arming jack to the transmitter battery. **Photo D** shows the payload section with the arming jack in place.

Measure 1-1/4-inch from the front of the payload section at a point 200 degrees clockwise from the arming jack and mark for the antenna. Drill a 1/32-inch hole at this point. Prepare a two-inch length of stranded hookup wire by stripping 1/4-inch from each end and tinning the wire with solder. Next, cut a 6-3/4-inch length of 1/16-inch music wire. Use fine sandpaper and burnish 2 inches of one end of the music wire. Measure 3/8-inch from the burnished end of the wire. Use pliers to put a 40-degree bend in the wire at this point. Push the prepared music wire into the antenna hole in the payload section so that you have access to the short bent section of wire. Solder one end of the two-inch wire you prepared earlier to the bent section of music wire.

Push the music wire back through the antenna mounting hole so the 6-3/8-inch length lies alongside the payload section. Use a short length of masking tape to hold the antenna in place while you lay in epoxy fillets on each side of the wire to hold it in place. You may find it helpful to tack the antenna to the payload section with cyanoacrylate adhesive before using the epoxy. **Photo E** shows the transmit antenna installed on the payload section.

Solder a 2-pin Dean's connector to the free end of the 2-inch antenna wire. The next step is to install the transmitter circuit board into the payload section.

Insert the transmitter circuit board, battery end first, into the payload section. Use care to position the circuit board to clear the arming jack as you slide the circuit board into position. Slide the prepared forward foam block into place. The 5/16-inch slot in the foam block should just clear the arming jack. Dress the remaining wires from the transmitter circuit board through the 1/8-inch slot in the foam block. I used an additional piece of foam rubber as a forward block inside the nose cone. This ensures that, once the nose cone is fastened in place, the

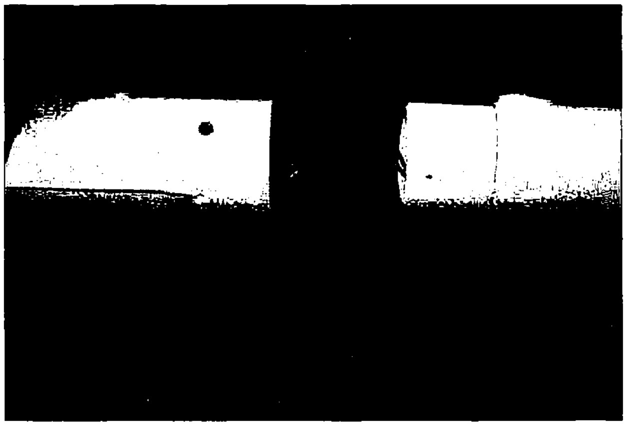

***Photo F.** Antenna, thermistor, and arming jack connectors.*

***Photo G.** Completed airframe in primer coat white.*

Qty.	Part
2	Astron 400-4 or Ramsey Electronics 400-4 yagi antenna kits
6	5 ft. lengths of 1-1/2 x 3/4 inch clear pine lumber
1	3 ft. x 3 ft. square piece of 1/8 inch standard hardboard
1	4 ft. section 5-1/2 x 3/4 inch poplar lumber
1	3 ft. section 3 x 3/4 inch poplar lumber
1	30 inch length 1-1/4 inch diam. hardwood dowel
3	3 inch x 1/4 inch carriage bolts with nuts
3	4 inch x 1/4 inch carriage bolts with nuts
3	6-32 machine screws with nuts
10	1-1/2 inch flathead wood screws
2	Radio Shack #15-826 U-bolt clamps
1	12 inch length 1/2 inch diam soft steel rod
4	1-1/4 inch x 1 inch PVC reducer adapter
1	8 ft. length Belden #9248 RG-6 75 ohm coaxial cable
6	UHF male coax cable connectors
2	UHF barrel double female coax connectors
1	UHF coax tee connector
1	UHF double female coax connector
1	UHF male-to-BNC male coax adapter

Table 1. Tracking antenna parts list.

transmitter circuit board will not shift under flight G-forces.

Connect the thermistor, antenna, and arming jack connectors, and then fasten the nose cone in place with the screws supplied in the rocket kit. Note: You may find it necessary to notch the bottom edge of the nose cone to clear the antenna wire on the inside of the payload section. I recommend placing an index mark on the junction between nose cone and payload section so proper alignment can be achieved later. **Photo F** shows the antenna, thermistor, and arming jack connectors.

Test the transmitter installation by turning on the receiver and then pulling the arming plug from the jack. If everything is working OK, you should hear tone pulses from the receiver. Reinstall the arming plug to turn off the transmitter. **Photo G** is a photograph of the completed airframe in primer coat white. The next article in this series will describe calibration of the thermistor temperature sensor, finishing the sounding rocket airframe, flight operations, data recovery, and implementation of the project with schools and youth groups.

ROCKET CONSTRUCTION NOTE: The rocket airframe has been built for launch from a tower, so no launch lugs have been installed. If you will be launching from a rod-type launcher, launch lugs will need to be installed on the airframe.

Addresses

Vaughn Brothers Rocketry, 4575 Ross Drive, Paso Robles CA 93446; tel.: (805) 239-3818; fax: (805) 239-0292.

Astron Corporation, 22560 Glenn Drive, Suite 114, Sterling VA 20164; tel.: (703) 450-5517; fax: (703) 450-9753.

National Association of Rocketry, 1311 Edgewood Drive, Altoona WI 54720; [www.nar.org].

Tripoli Rocketry Association, Inc., P.O. Box 280, Bessemer AL 35021-0280; tel.: (205) 424-8357. 73

Qty.	Part
1	Vaughn Brothers Extreme 38 rocket kit
1	8 inch length 1/16 inch music wire
1	12 inch x 12 inch square section R/C packing foam rubber (available from hobby shops)
1	2 inch x 2 inch square sheet 0.005 brass (available from hobby shops)
1	6 inch length #22 tinned solid wire
1	Dean's Ultra Plug 2-pin power connector (available from hobby shops)
2	Dean's standard 2-pin connector (available from hobby shops)

Table 2. Airframe parts list.

John Grow VE2EQL
210 Vercheres
Greenfield Park, Quebec
Canada J4V 2B4
[jgrow@sympatico.ca]

Build Yourself an NVIS

If you want to talk to the guy in the next county on HF, of course.

We have all experimented with antennas. At one time or other we played with dipoles, verticals, quads, yagis, and variations of wire antennas. All for the desire of a low-angle signal, which will help us snag DX stations. There have been numerous articles and books on antennas, making us very familiar with the above antenna names. But have you ever heard of the Australian " District Antenna," or the Russian " Zenith Radiation," or what our military calls NVIS (Near Vertical Incidence Skywave)?

This antenna has been around since World War II. The reason most hams have not heard about it is their desire to work faraway stations. When it comes to local communications, VHF/UHF is more common. But there are many cases where the range of VHF is limited, and reliable communications are needed on HF.

In many population centers, there is the desire of many hams to communicate within a 100- to 300-mile radius.

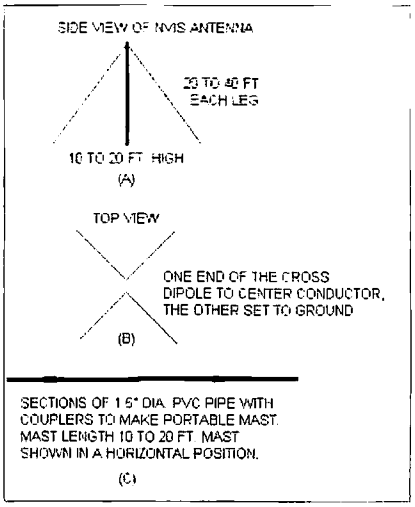

Fig. 1. NVIS antenna details.

In those cases, the known popular antennas might not provide a reliable link. Our military had the same problems, and they found that producing a high angle skywave provided a reliable link, less subject to fading. With a high angle, the surrounding terrain is not an issue.

How to experiment with NVIS

There are many ways an antenna can be made to work in an NVIS mode. The easiest is to run a wire fed with a tuner a few feet from the ground. In most cases, a high-angle skywave will be produced. Stations nearby will be able to communicate.

Another approach is to take your HF mobile antenna and place it in a horizontal position parallel to the ground. You could experiment with the distance between the ground and horizontal antenna. A distance of 3 to 9 feet will work.

When experimenting with NVIS, 80, 40, and 30 meters seem to work best. I tried frequencies between 3.5 and 30 MHz. The factors of working frequencies below the MUF (Maximum Usable Frequency) play a very important role. Power levels of QRP to 100 watts have been used.

Building a simple NVIS antenna

A very simple NVIS antenna can be built, for fixed or portable use. (Please refer to **Fig. 1**.) The basic NVIS antenna is nothing more than two crossed dipoles mounted anywhere from 10 to 20 feet high. The legs of the dipole are sloped and secured to the ground. The crossed dipoles are fed with 50-ohm coax. A tuner, manual or automatic, is required.

A fixed NVIS antenna can be a wooden pole, PVC pipe, or metal mast. The lengths of the wire elements can be anywhere from 20 to 40 feet. For a portable NVIS antenna, a mast could be made from 1.5"-diameter PVC tubing mating with PVC couplers. A piece of coax fed through the mast then feeds the crossfed dipoles.

Please make sure that safety concerns are taken into consideration. You do not want anyone to run into the sloping wires, which will be a few feet off the ground. This type of antenna has been made commercially by Telex. It is called the NVIS Antenna, with a model number of AS-2259/1990.

Continued on page 58

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Inside Digital TV/VCR Tuners

Part 7: Conclusion.

The previous section described how the printed circuit boards for the data transmitter and receiver are prepared for processing. This section will complete the process steps, beginning with marking the board.

It is desirable to have some identification markings on the board indicating voltage values, polarity, IC pin and transistor lead identifiers, etc. Prior to etching, a sharp instrument like a scribe may be used to scratch through the fingernail polish, exposing the copper as shown in **Photo A**. The scratch marks in the form of letters and symbols will be etched into the copper as shown in **Photo B.**

Many of the black ink etch-resist marking pens contain a water-repellent ink that is sometimes used for marking the bare copper prior to etching. Unfortunately, the ink does break down somewhat in the etchant, so that it isn't always satisfactory for making a reliable etch-resist for trace patterns. After etching, the marking pen is more suitable for marking the component placement, orientation, polarity, etc., information on the top side of the board.

Etching the board

Ferric chloride is the most common etchant available and perhaps the easiest and safest to use. The major caution with it is that it is dark in color and will severely stain cloth, so care must be taken to prevent spills and splashes.

The board will be ready to etch after the nail polish has dried — usually 30 minutes to an hour is a proper waiting period. There are many methods suitable for etching a board, but the one most suitable to your needs is the one that you should use. A simple and easy method is to pour the etchant to a depth of 1/8–1/4-inch into a flat glass or plastic dish. Float the board copper side down on the surface of the etchant. It will be necessary to lift the board periodically after about 30 minutes to assess the progress of etching

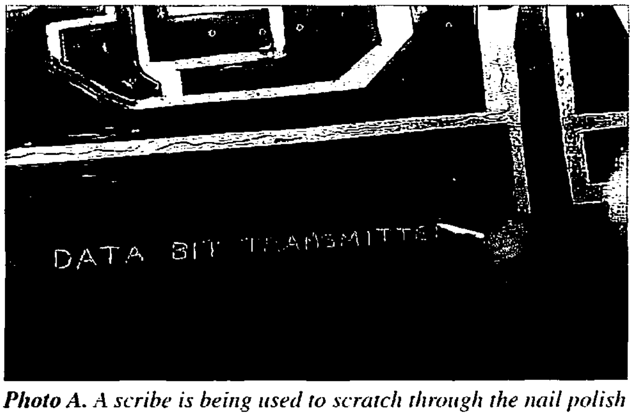

***Photo A.** A scribe is being used to scratch through the nail polish for marking/identifying the board.*

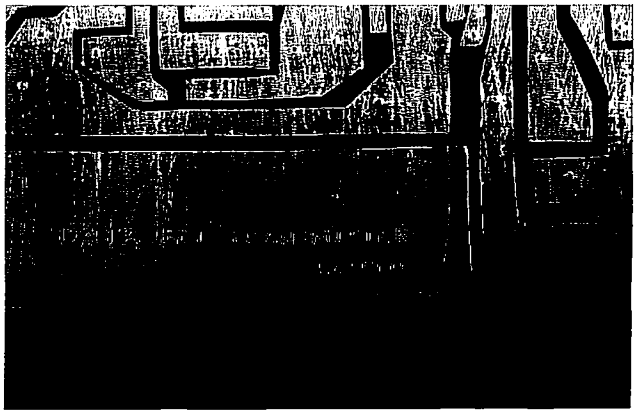

***Photo B.** The board marking that remains after etching.*

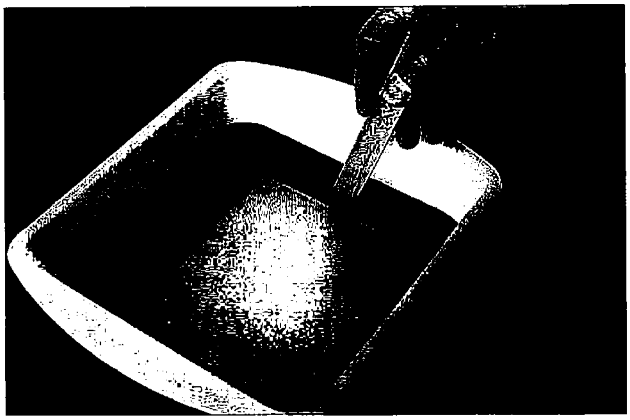

Photo C. *The circuit board floating on the etchant. A stick is used to lift the board momentarily to purge bubbles.*

Photo D. *A scribe is used to scratch unetched copper bridges before returning the board to the etch.*

as shown in **Photo C**. A stick or tongue depressor works well for lifting the board. Also, lifting the board, then lowering it slowly, will allow the trapped bubbles to be purged.

When the etching process appears to be complete, remove the board, wash it with tap water, and dry it with a paper towel. The board can now be inspected for completion. Some areas, specifically where bubbles were trapped, will not etch very fast. Scraping those areas with a knife blade or scribe to scratch the copper will allow the copper to be etched a little faster, as shown in **Photo D.** Return the board to the etch and allow the etching process to continue. When wide trace patterns are used, overetching is usually not a problem.

During a cold environment, the etchant works very slowly. Adding a little heat to the process will speed it up considerably. Placing a small light bulb close to the etchant will warm the surrounding air. Also, placing a small cardboard box over the lamp and etchant tray will raise the temperature sufficiently to speed the etching process.

An alternate method for etching boards is to use a zipper-style plastic bag as an etch container. After the board is placed into the bag, about one inch of etchant is poured into the bag. Because some bags have a tendency to leak, it's a good idea to slide the first bag containing the board into another bag for drip protection.

After sealing the bag(s), the board is positioned flat with the copper down. Because the bag is transparent, the etching process can be observed through the bag. Handling the board and bag with care is OK, but excess handling should be avoided to prevent accidental spills caused by bag tears.

After etching

Upon completion, the board must be washed with tap water to remove the etchant. If the board is to be a single-sided board, then the nail polish can be removed with lacquer thinner or acetone. A small amount of solvent on a paper tissue works well as a wiper. An etched board with nail polish is shown in **Photo E**.

Following an inspection of the trace pattern for copper bridges and other possible minor defects, the board is ready for drilling (**Photo F**). Hole sizes are a personal choice, but drill sizes from #57 to #62 work well for most applications.

Solder-coating the copper is an optional process, but it does help reduce oxide development on the surface of the copper. The advantages of solder coating are better part solderability and uniform appearance, in addition to

Photo E. *This is the etched board after being washed, but before the nail polish has been removed.*

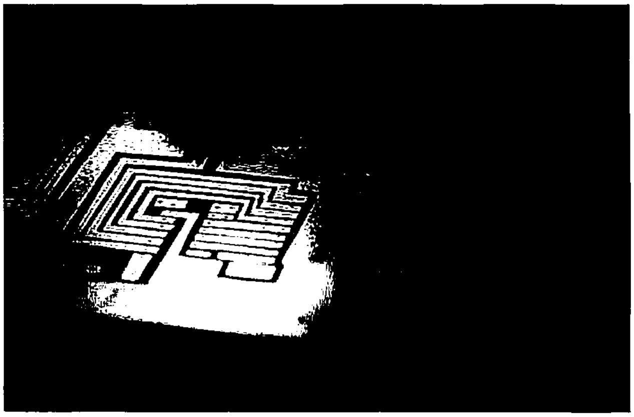

Photo F. *Drill sizes from #57 to #62 work well for drilling the holes.*

the reduction in copper oxide formation. The involved steps begin with cleaning the copper with fine steel wool followed with a solvent rinse. The objective is to remove all traces of nail polish, oxides, and oil.

The procedure for solder coating the board is as follows:

1) Coat the surface of the copper with a very thin coating of solder flux.

2) Place a small drop of solder on the tip of a 25–30 watt soldering iron.

3) Touch the solder to the copper and draw the iron along the copper. A solder trail will be left as the iron moves. Solder may be added as necessary to continue the process.

4) Continue the solder coating process until all of the copper is coated. It will be necessary to move the iron reasonably fast across the copper to reduce the possibility of burning the adhesive below the copper.

5) Clean the coated board with alcohol, lacquer thinner, or acetone to remove the flux.

Double-sided boards

Making double-sided boards is a little more difficult than the process outlined above. However, the same steps are repeated except for drilling. Drilling is done from the bottom side (most complex trace pattern side) of the board.

During the etching process, the side opposite the pattern being etched must be protected from etching. Coating the "protected" side with nail polish or with a couple of layers of plastic spray is sufficient. After the first side is etched, it is sprayed with plastic or the exposed areas of copper are coated with nail polish to prevent further etching of those areas. Care must be taken so that the "protected" side is not scratched during handling. Coating the "protected" side a few minutes before etching is best.

Preparing the second side of the board follows the same steps as the first, but orientation of the trace pattern is a little tricky. It is best to have the majority of holes drilled before the second side is started, as the holes are

Continued on page 22

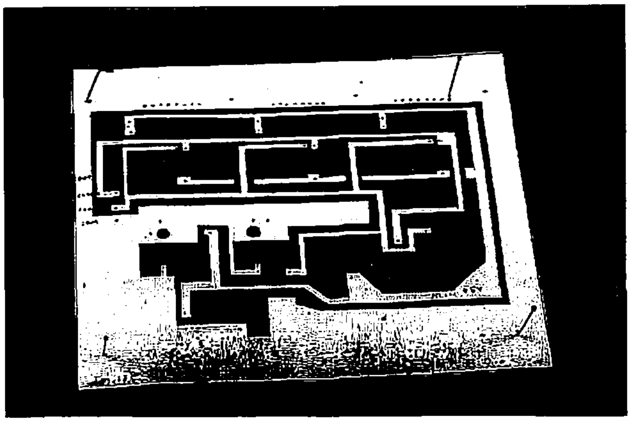

Photo G. The second side paper mask is positioned prior to being cemented.

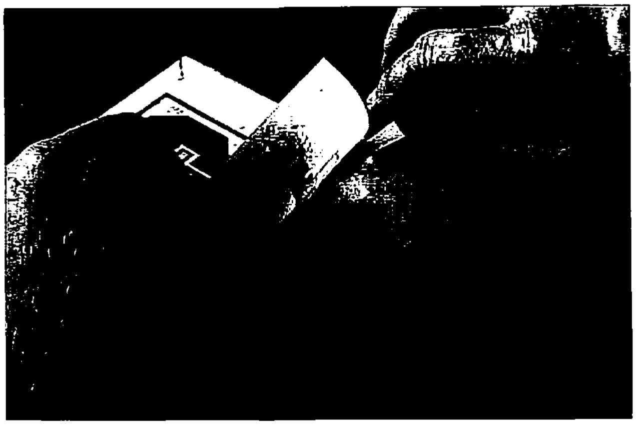

Photo H. The first half of the paper mask has been aligned and cemented, while the second half is being cemented.

Inside Digital TV/VCR Tuners

continued from page 21

used as a guide for placing the paper mask.

In preparation for placing the paper mask onto the second side, the following steps are recommended:

1) Place the mask on the board without cement and orient the pattern to match the drilled holes.

2) For an alignment check, hold the board up to a light and observe the light passing through the holes. View the board from the topside pattern.

3) Push two or more straight pins through the corresponding mask "holes" into the board holes and note the proper trace orientation as shown in **Photo G**.

4) When satisfied that the orientation is correct, coat the copper and the paper mask with rubber cement.

5) With the straight pins pushed through the paper mask, use the pins as alignment guides while dropping the paper onto the copper as shown in **Photo H**.

6) Remove the pins and rub out the bubbles and excess cement.

With the mask in place, the trace pattern may be cut and removed, as was done for the first side. During the mask removal process, any misalignment of the trace pattern may be corrected as the process is performed, while using the mask lines as a cutting guide. Deviating from the drawn pattern may be necessary to correctly pick up the drilled holes.

Double-sided boards made commercially usually have plated-through holes. Unfortunately, the plating process required for making the plated holes may be outside of the reach of the average ham, so the data transmitter and receiver boards have been laid out for "Z"-wires as was shown in part 6, Fig. 5. The objective of the "Z"-wire is to connect the circuit trace on one side of the board to the trace on the other side. On the project boards, the solder pads have been extended away from the IC pin or transistor lead far enough for a wire to be passed through the board. Where "Z"-wires are used, component leads need to be soldered only to the bottom side of the board, as the "Z"-wire will transfer the connection between board sides.

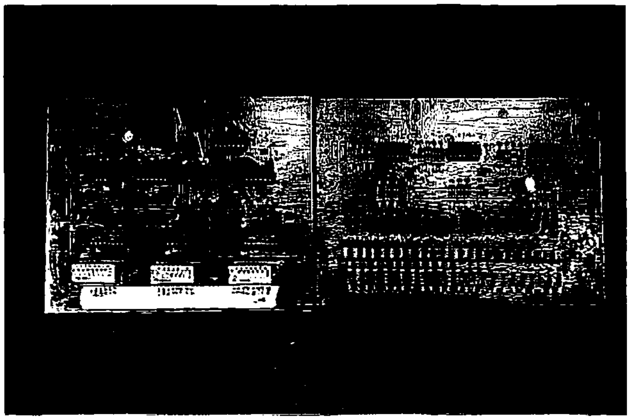

Photo I. This photo shows the operational prototypes of the data receiver (right) and the data transmitter (left).

Some bypass capacitors and the filter capacitors will require soldering onto the upper surface traces, because holes have not been provided. Placement of the capacitors is at the user's option. As an example, the 100-500 µF filter capacitor(s) may be placed anywhere on the board where the +5 volt trace runs close by the ground trace.

Photo I shows the completed prototype boards for the data transmitter and receiver. Trace pattern errors found in the prototypes have been corrected for the patterns provided herein.

I've been using the fingernail polish resist method for making printed circuit boards for a great many years, and can attest to the reliability of the process. I hope that you will see the merit in the simple process steps involved and will give it a try.

Alternate boardmaking techniques

Because of the wide variety of printed circuit board processing techniques available, some alternate methods can be found on the Internet. The techniques indicated below utilize the plastic toner used in copy machines and laser printers as an etch-resist.

Here are four good URLs:

- [http://geocities.com/pdmtr]
- [http://www.techniks.com/press-n-peel.html]
- [http://www.qsl.net/ei9gq/pcb.html]
- [http://www.nordicdx.com/dxlab/makepcb2.html].

Carl Markle K8IHQ
11570 Taylor Wells Rd.
Clairdon OH 44024-8910

Build This Variable AC Bench Supply

If you can find a Variac transformer, that is.

How many times have you home-brew folks had the need for a variable 120 VAC power supply? Well, at least several. We know that working with 12 volt DC on the bench is certainly no problem. If a mistake is made, you might lose an IC or two, but no fires erupt. With AC — well, things can get lethal before the fuse blows, and this is especially true when using 120 VAC. We have all done those dumb things that have jump-started our heart from time to time. This "Variac" variable supply will prove safe on those start-ups of those questionable home-brew circuits that require AC supplies.

Let's look at the central component, which is called a Variac transformer. This is also known as an autotransformer in some circles. A certain ham who has tried to declare himself to be the authority in this field has also called the "autotransformer" a current transformer when it is used in RF impedance matching devices called baluns.

Well, it is particularly a variable secondary winding transformer that allows a continuously variable primary-to-secondary ratio, thus providing a continuously variable AC voltage from zero to 130 VAC. These devices have become very expensive when purchased new, and are usually in the $130 range for the 3 A models. I do not recommend the purchase of a new Variac transformer.

Now, look at the list of local hamfest flea market supply get-togethers. Usually a five dollar entry fee will get you into one of these events. They take place usually on Sunday mornings from 9 a.m. to 1 p.m. You can look into *QST*, *CQ*, or *73* magazines under the "coming hamfests" section to determine the location and date of each event. You can also check into your local two meter repeaters and someone can help you, since nearly all of the events are sponsored by repeater groups. Anyway, look for a Variac under the vendors' tables since they do not seem to have a high dollar value or a large demand these days. I found mine for a price of fifteen dollars. I did not even try to bargain or dicker, since the condition was very good. Try to ensure that the knob is with it, since the completed unit with knob will look more professional. Finding a replacement knob can become a real problem, so do your best.

The next item is some type of voltage indicator. It is possible to use a digital voltmeter and do calibration on the front panel, but a nice analog AC voltmeter is best since the AC line

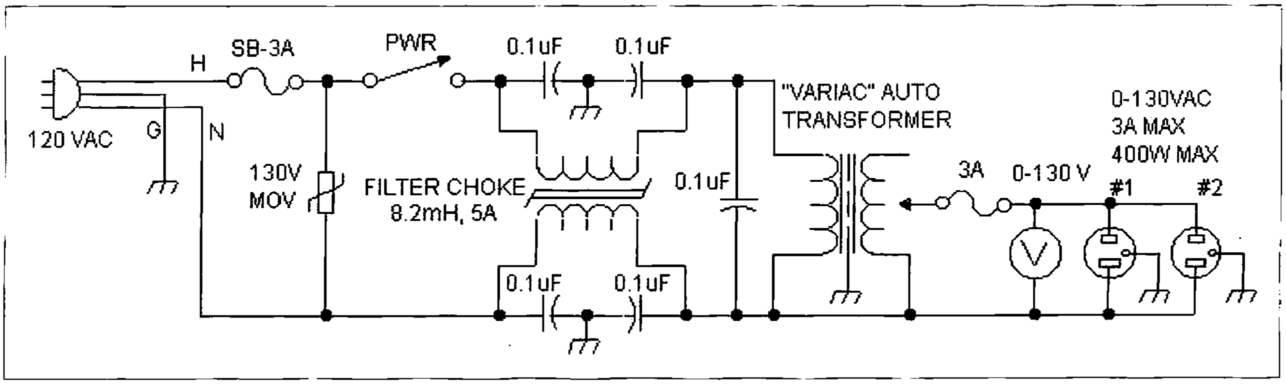

Fig. 1. Supply schematic.

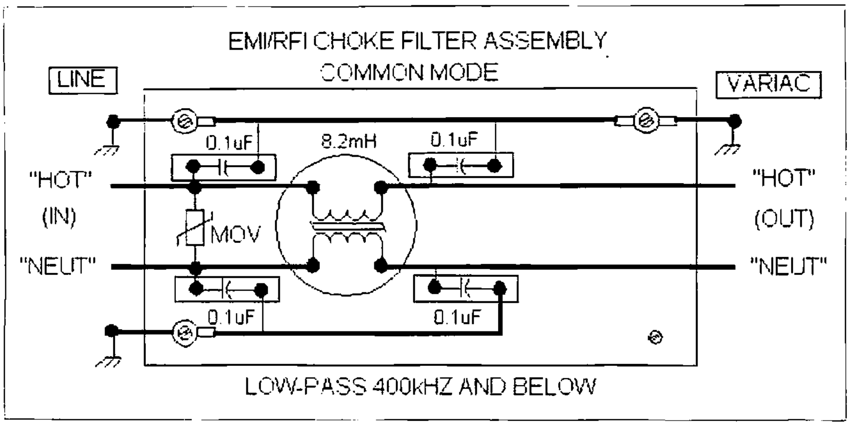

Fig. 2. EMI/RFI choke filter assembly. Mount using 0.25-inch aluminum standoffs.

voltage may vary at your location. I found an old Lafayette model #99-51161 0-250VAC type. The vendor wanted one dollar, so I smiled and paid the man and thanked him. It's that old story of one man's junk is another man's gold. He also had several new, boxed Heathkit 200 µA meters for one dollar each. No, you do not have to ask me! The plastic covers snap off and two screws hold the metal scale plate in place, so reversing the plate and drawing a new scale is not a problem on these meters. With a shunt resistor, the meters can be used for nearly any DC application. A trimpot in series will adjust the scale in the voltage mode. For AC, you can use a bridge rectifier and adjust. All this "stuff" is in your *ARRL Handbook* and many other good books. Be creative, spend one buck, and have some fun. If you feel you just have to purchase a new, good-looking meter, you can go to your local Radio Shack and order one (RS #22-412) at about thirteen dollars a pop!

For safety's sake, we want to double fuse the little box. Use a 3 A slo-blo 3AG fuse on the primary side and a 3 A fast blow 3AG on the secondary side. This is all the protection that is needed. That expensive Variac needs primary and secondary protection for sure!

When working on electronic projects, it is always nice to filter the 120 VAC line to keep garbage noise out of the circuits being tested or developed. An inexpensive low pass (common-mode) filter is employed on this project, and can be seen in **Fig. 1**.

Photo A. In case, ready to go.

Something like an electric motor appliance putting common-mode noise on the line will give you nightmares. An inexpensive common mode filter is installed, which all but eliminates noises from appearing on the primary or secondary of the Variac transformer. Working with digital circuits using a DC wall transformer for power can move tremendous hash and noise to the 120 VAC line and get unbelievable noise from the folks you live with. The 8.2 mH filter is rated at 5 AC amps (RMS) so the 3 A requirement is well covered. The 0.1 µF capacitors and 130 VAC MOV take care of any large peak voltage spikes very well. This is nice insurance in case a transient tries to get to the filter circuit. The MOV or metal oxide varistor device is for those unexpected current slugs that the electric utility ignores. It will clamp off at the 150 V level, figuring in the variable voltage to variable time factors. This device is rated at 130 VAC but is just not very fast.

The line cord must be a three conductor (NEMAL) type preferably in the AWG #14 wire size. The green ground wire, when attached to the aluminum enclosure, will ensure safe operation no matter the situation. It is required these days by NEC (code), so it is a good idea to use it. Another note on the source of AC power which should be covered is the problem of GFI (ground fault) devices. If you use one of these safety devices to supply your power to the workbench be aware of all the Triac/SCR noise that they produce. The common-mode filter will take care of that nasty little item. I have considered using this filter as a filter on the devices which NEC requires in the bathroom areas and when within six feet of water. That is another weekend project for the future!

Now, let's look at the enclosure situation. Any type that is aluminum would be OK. Again, we are looking for some degree of safety since we are fooling around with 120 VAC. I found a Ten-Tec Model MW-8 enclosure at a flea market and purchased it for five dollars. The new price is about seventeen dollars plus shipping these days. Just be creative!

Well, the MW-8 I found had holes in the bottom, back, and also the front panel. The hole in the front got bigger to accommodate the AC voltmeter. The other front holes got covered by a piece of contact paper purchased at a local office supply house. Use a black felt marker to put the markings and scales on. The holes in the rear of the enclosure were enlarged to handle the two fuses, and one new one was made for the 0.5-inch strain relief for the line cord. Again, use the felt marker to identify the fuse sizes, etc. The marker can be had at your local post office for one dollar! It has both a broad and very fine point. What a deal for one buck!

Once the components are mounted, you will be ready for the wiring of the unit. Use insulated AWG #18 or larger. See **Table 1** for parts info. The suppliers' info is listed below in the text. The use of clear 100% silicone caulk to mount the components onto a perforated board works well. Or, you can use the PCB available from FAR Circuits. (I originally used perfboard, but now there is a PCB available.)

Now that you have all the components and assemblies, you can wire the components together using the schematic. Follow the schematic in **Fig. 2,** and as each wire is installed use a yellow hi-lighter (Broad Point) to mark each wire on the schematic. I find that nearly no mistakes will happen when this procedure is used.

When everything is wired and checked, you can plug it in and flip the switch with the Variac at zero volts. No smoke generally indicates you have done a good job. A blown fuse indicates you did something wrong! If everything is OK, then plug a lamp into the utility plug and turn the Variac slowly to 120 VAC, watching the bulb's intensity increase as voltage increases. Ensure the AC voltmeter is also functioning correctly.

Now you have a soldering iron heat controller — among some other good things! Good luck!

Qty.	Part	Source	Cost
1	MW-8 enclosure	Ten-Tec	$17.00
1	3A SB fuse #31-155	Hosfelt Electronics (HE)	.30
1	3A fuse #31-359	HE	.06
2	Fuseholders #43-206	HE	1.50
1	Strain relief	Local	.25
1	Line cord #60-372	HE	1.75
1	120 VAC 3A Variac auto xfmr	Hamlest or flea market	15.00
1	130 VAC MOV #V130LA20B	HE	.60
2	Panel-mount AC receptacles	Local	1.00
1	150 VAC panel meter (RS #22-412 = $13)	Hamfest or flea market	1.00
4	0.1 µF 250 VAC box caps #15-828	HE	.25
1	Dual 8.2 mH toroid choke 250 VAC 5A 0.2 Ω #18-129 Pulse Engg #96180	HE	.35
1	SPDT 3 A toggle switch #51-268	HE	.75
1	Perfboard RS #276-1396	Radio Shack	3 50
	OR		
1	PCB	FAR Circuits	4.00 + 1.50 s/h
4	Sets aluminum standoff hardware #6	Your choice	1.00
3	Solder lugs #6	Your choice	.15

Table 1. Parts list.

Notes/Sources

FAR Circuits, 18N640 Field Ct., Dundee IL 60118-9263. PCB is $4 + $1.50 S/H.

Hosfelt Electronics, (1-888-264-6464), catalog.

Jameco Electronics, (1-800-831-4242), catalog.

Ten-Tec, (1-800-231-8842), catalog.

Jim Kocsis WA9PYH
5380 Flicker Lane
South Bend IN 46637

$5 Infrared Remote Tester

Build this and look like a hero.

This article describes a simple device to test all kinds of infrared transmitting devices. All parts are available at Radio Shack at a total cost of around $5. It has no adjustments and the physical layout is not critical.

Okay, you're a ham. By default, you're also the electronics expert of the family. On call "24/7" (hours a day/days a week) for all kinds of questions. For example, some family member tells you: "My TV remote doesn't work." What do you do? First, you check that the batteries are installed properly, then you check the batteries with your DMM/VOM to make sure they're good. You point it at the TV, CD player, DVD player, etc., and hopefully it works. If it does, you're a hero for discovering that the batteries were put in backward after the old dead ones were replaced.

But what do you do if it still doesn't work? How can you tell if the problem is in the remote or the TV? I suppose you could go to a store and buy one of those universal remotes. But what if you're checking an IR keyboard or mouse or other device with an IR transmitter that doesn't have a generic replacement available at the corner store?

This article describes an IR receiver that tells if the IR is transmitting by blinking an LED at the same rate as the transmitted signal. You can build this very simple project for about $5 and have a portable checker that you can loan to friends, relatives, and neighbors. All parts are available at Radio Shack; if you have the proverbial "well stocked junk box," you may already have most parts on hand.

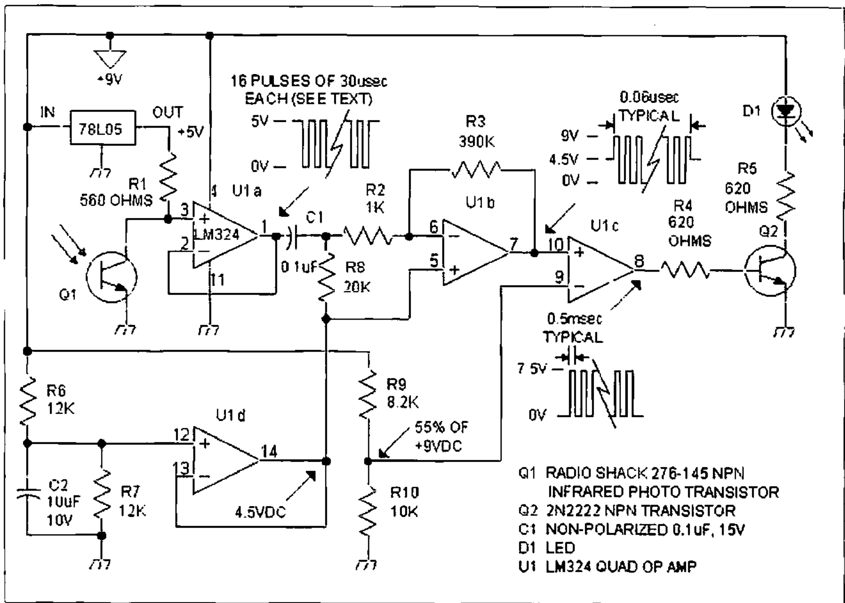

Fig. 1. Schematic with typical waveforms.

Circuit operation

The schematic with typical waveforms is shown in **Fig. 1**. The incoming IR signal shines on the domed top of transistor Q1, causing it to conduct current, resulting in a voltage drop across R1. Op amp U1a is wired as a buffer to isolate the detector from the rest of the circuit. C1 couples the signal from this buffer to amplifier U1b. U1d with R6 and R7 provide a "stiff" virtual ground halfway between ground and the supply voltage. This virtual

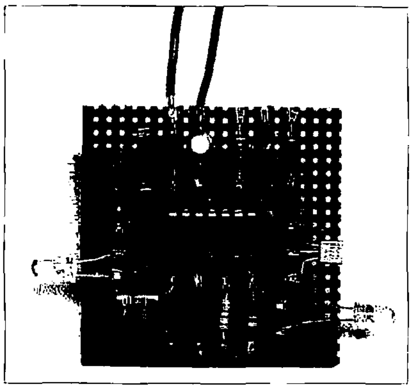

Photo A. Here's the board, right out in the open so you can get a good look.

ground is used to make the power supply act like it is a ± 4.5 volt power supply. The bottom of R8 is tied to virtual ground to keep the input to U1b from floating to V+ or V–. If the input did float either high or low, operation of the circuit would cease.

U1b with R2 & R3 amplify the signal by a factor of 390 (R3/R2). The voltage at U1b pin 7 is halfway between V supply and ground, with the IR signal superimposed on top of it. By amplifying the signal by a factor of 390, it saturates the output of U1b. The squarewave output of U1b goes from 1.5 volts less than the supply voltage to true ground. U1d is used as a comparator. Pin 9 is held at 5% above virtual ground by resistors R9 and R10. Pin 8 goes to +7.5 volts when pin 10 is more positive than pin 9. Q2 is turned on through R4 only on the positive part of the squarewave signal from U1d. Q2 lights the LED.

I used an LM324 since it is capable of accepting and outputting a low voltage right down to 5 millivolts above – V supply (pin 11). This is needed since Q2's base must be less than 0.65 volts above true ground to shut off with no incoming signal.

The waveforms shown on the schematic represent just part of a complex waveform. Vary the timebase of an oscilloscope from 0.5 milliseconds to 20 microseconds to see all parts of the actual waveform. The amplitude at U1a pin 1 will vary with distance. I obtained 3 volts peak-to-peak at 3 inches. The maximum working range was 23 feet. The signal at the IR sensor at this distance is of course very low.

Construction

I constructed my unit using perfboard and push-in clips. I didn't choose to lay out or fabricate a PC board since I built only one unit. Before mounting the board in a small box the project looked like **Photo A**. The completed unit can be put in a small box (**Photo B**). I suggest locating the input transistor at the end of the box and the LED on top of the box.

You will have to perform testing in a dimly lit room (not total darkness) or shield the IR detector with an opaque tube to let light in only from "head-on." If sunlight or bright lights are shining on the detector, the LED will be on full-time and prevent you from testing a remote unit. You could also reduce the gain of U1b so the tester is not as sensitive, but I did not try this.

An interesting point is that you can see the 60 Hz sine wave from an incandescent light bulb by monitoring pin 1 of U1 with an oscilloscope. You will have to adjust the sensitivity of the oscilloscope to accommodate the signal level since it will vary with the distance to the light bulb.

Summary

You can build this project in just a few hours. With it you can help neighbors, relatives, and fellow workers troubleshoot their IR transmitter devices. If you make it look homemade, people will likely ask how you knew to build a tester like this. Use that opportunity to talk up electronics and ham radio as a hobby.

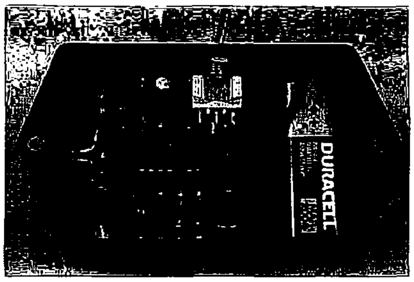

Photo B. The completed unit.

There are probably some changes you can make to produce a waveform at IC1b pin 7 that is a little more squared off (it is quite rounded off) and more accurately represents what is actually being sent from the IR transmitter. I didn't bother to research this any further since I just wanted to know if the IR remote was actually transmitting. If you have an oscilloscope, monitor pin 1 to see the differences between codes sent when pushing different buttons.

I had fun building and debugging this project. If you build it, please let me know how you like it and if you made any changes. I would like to hear from you. Don't be surprised if you get that "Gee, what an electronics genius you are!" look from someone you help. Happy soldering!

Erik Westgard NY9D
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QRP Drives Ham Nuts

Buys "critical mass" of parts and then goes on bizarre building spree.

As with most of my hobbies, my interest in amateur radio has waxed and waned over the years. Until about a year ago, I was in an amateur radio downturn. I had even sold my HF rig, and was in possession of only my trusty collection of ancient Icom u2AT and u4AT handhelds, and a Sony shortwave radio.

For some reason, I decided that QRP was going to be the spark this time around, and determined that when I got back on HF, it would be with a rig I built myself. I had an old copy of the 1986 edition of the *QRP Notebook* by W1FB, and reread it cover to cover four or five times. My files bulged with QRP articles torn out of magazines, and I thought I had accumulated a good supply of parts over the years.

Full of anticipation, I pulled out WBØNQM's 11/1990 *73 Amateur Radio Today* article, "TTL Transceiver for 40 Meters," and headed for the workshop. A quick review of the parts list revealed a big shortfall. Our local electronics store and three nearby electronics surplus stores were almost no help. You could find 2N2222s, the occasional MFP102, and assorted resistors and capacitors, but for toroids, magnet wire, interstage transformers, or variable caps, it was going to require extensive planning ahead. No amount of searching revealed a single receiver or transmitter that could be built with in-house stock, or parts available locally.

I ended up having to rummage through all the available ARRL/W1FB books and my article file, making lists of parts I was likely to need. I ordered a handful of every type of toroid mentioned, and rolls of magnet wire. The Radio Shack magnet wire assortment covers only half of the common sizes, and they don't stock toroids. (They do have an assortment of largely unmarked TV-type RF coils and chokes, but these are mostly not useful for QRP work. You wonder why they don't have a toroid assortment ...)

Below is my Amidon shopping list, which has enabled me to tackle most of the projects I have found. Dan's and other outlets sell most of these items. Fry's Electronics stores even stock T50-2 and FT37-43 toroids, and some sizes of magnet wire. The list:

1 BN43-3312 balun
1 BN43-202 balun
1 BN43-7051 balun
8 T37-6 iron powder toroid
4 FT30-43 ferrite toroid
8 FT37-43 ferrite toroid
8 T50-6 iron powder toroid
6 FT50-61 ferrite toroid
6 FT50-43 ferrite toroid
6 FT37-61 ferrite toroid
2 FT37-63 ferrite toroid
6 T68-2 iron powder toroid
4 T37-2 iron powder toroid
8 T50-2 iron powder toroid
6 T68-6 iron powder toroid
1 pk DFB43-101 ferrite beads
1 pk DFB43-301 ferrite beads
1 spool each #20, #24, #26 magnet wire

This whole list was around $95.

From Dan's, I ordered some 2N3866s, CA3046s, NE602s, and some MC1496s. He also has RCA 40673 parts, and 10.7 MHz IF cans, which appear in many projects. I also got a number of air variable capacitors and mica capacitors from him. From Mouser, I got more IF transformers, 4k/600 ohm transformers, some tuning caps, and RF chokes.

After literally ten orders from various web sites, I thought I had a critical mass of parts. Here are rigs I built, and the results I had:

TTL Transceiver for 40 Meters (Rick Lucas, WBØNQM, *73*, 11/90, pp. 30–32). This one appealed to me — it looked simple, and I was sure I had most of the parts. I ended up having to place several orders to get the chokes and 1.0 μH variable. The local surplus store had the TTL heat sinks, but that was it. The receiver never

worked properly due to local AM overload. I think the old Mylar variable cap I had in my parts bin was suspect. Note that FAR, who supplies circuit boards for many projects, will also provide reprints of the original magazine articles for a small charge.

Poor Ham's QRP Rig (*W1FB QRP Notebook*, 1986, pp. 30–31). After stern admonitions from W1FB on the necessity of having a good enough rig for a proper signal, this one had several stages and looked solid enough. I had trouble here in the output stage — and learned that an 820 pF ceramic cap that says 820 on it might be an 820, or it might be an 82. An 821 is a better bet. This one is reliable, and with all the stages has made a good test source, as it is not all that sensitive to changes in loads. And this one needs #24 magnet wire — not in the Radio Shack assortment. Using the Sony shortwave in SSB mode, I spent hours trying for a first contact with the transmitter connected to a dummy load. I swear I almost got someone to respond.

Boots for the 1-Watter (*W1FB QRP Notebook*, 1986, pp. 32–33). Learning the futility of calling CQ QRP, I tried this amp. The first effort, with junk box transistors, did not work. I learned about the need to have f_T several times higher than the target frequency. It was nice to not need a special RF transformer — but if you are ordering toroids from Amidon, what's another item on the list? This one finally worked for a minute, and then stopped. I think I have excessive wire lengths someplace.

Cubic Incher (80m) (*1986 ARRL Handbook*). Try finding a 1000 pF trimmer cap anywhere. Our local antique radio store (there is not one in every city, alas) had some mixed larger square trimmers in a bin. A $14.95 capacitance meter add-on (used in solving the "is 820 really 820" issue above) revealed a 1000 pF model. This worked well with a spare TV colorburst crystal, and an NTE transistor from our local electronics store. I miswired the power just once (learning about protection diodes) and had to get a new transistor, this time an ECG. Now the transmitter was chirpy. This one went on the shelf, until a Michael Jay Geier KB1UM article "Cassette Box Special"(*73*, 4/90, pp. 46–50), suggested that cheap color burst crystals were not a good idea for transmitters. I changed crystals — no chirp.

Two-Stage Regenerative Receiver (*W1FB Design Notebook*, p. 109). Despite admonitions that minimum-component receivers were frustrating, I built this one, and spent hours putting it in a metal box. It had weak output, never worked properly. I also learned I am a few miles from a powerful AM station that gets into everything. Adapting knobs to those large screwdriver-type trimmer caps is not fun.

Small Wonder Labs/ SW+ (NN1G) Kit. Having learned a thing or two about toroids, I tried this kit. The crystal filter, "grounded to reduce blow-by" was just the ticket for eliminating interference from my local AM station. The signals were nice and clear — and hearing stations on a rig you built yourself is every bit as good a feeling as advertised. I learned I make one wiring mistake for every ten connections wired or components installed. There is nothing wrong with the directions here. Moving to a transceiver and having frequency agility is luxurious. The price for this one as a board-only kit is very attractive.

Small Wonder Labs/ White Mountain 80m SSB Kit. After some time playing with the SW+ above, I remembered one thing — I hate CW. This kit was complex, but well within my comfort level. It worked the first time, which was a plus. It receives really, really well, but attempts to reach my local SSB section net (with most stations running kilowatts) were futile. I bought a new HF rig about this time — "to tune the antenna." I said. I broke down and got the matching cabinet and frequency counter package — it looks nice, and it's fun to know where you are on the band.

Ramsey Q80 15W Amplifier Kit. Determined to reach the Minnesota Traffic Net, I bought this kit. I put it together in several rushed hours counting down to the traffic net. The first try, it behaved just like the "Boots" amp above — one transistor (actually MOSFET) got really hot, the other was cool. One of the output filter toroids required doubling up on the windings, which seemed suspect, so I called Tech Support at Ramsey. He said to check the transformer wiring, making sure the insulation was not scraped in the core, causing a short. He said the filter toroid was OK with two layers. I found I had not scraped enough coating off one of the transformer windings entering the board prior to soldering. On power up I was getting 100 watts out, and a poor tone, which the book said was due to a bad match. I was running to the dummy load via the tuner at some random setting. Oh, well. The

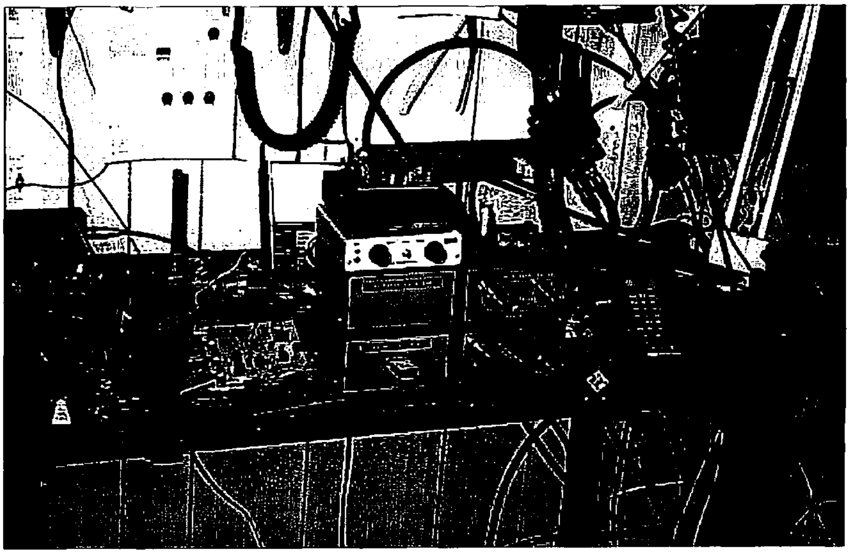

Photo A. Some of the rigs built by NY9D.

directions for this one are really good — they tell you the functions of many of the parts as you install them. I did finally reach my net with the White Mountain rig plus the amp.

W1FB Five Watt Class C 5W Amp (*W1FB QRP Notebook*, 1991, p. 129). While waiting to call Ramsey, I took a day off from work, this time for a non–push-pull amp, which I was determined to get working. This one called for 560 pF mica caps. Rather than guess if some nice micas marked 560 were really 560s, I had some giant, waxy color-coded jobs from a grab bag at Dan's. These had 560 written in marker. I drilled out the holes in the FAR Circuits PC board for the thick leads. (This is not good if your boards have plated holes.) In a surprise move, this amp worked the first time. Wow. I also found out that my Poor Ham's 40m transmitter had a grungy-sounding signal when amplified, so I tuned it up. With the help of my handy transistor substitution book, this amp was powered by the output transistor from one of six broken CBs I got for a dollar each. One rule I have learned: If you want radio parts in your junk box, you pretty much have to start by taking apart radios.

W1FB Universal DC Receiver (*W1FB QRP Notebook*, 1991, pp. 77–82, Fig. 3-27). Finally believing W1FB on the "too-simple" receiver issue, I ordered up the board for the Universal DC receiver from FAR. This would also be the ultimate test of my new junk box, which was mostly filled with stuff I had ordered. I also have been busily accumulating more electronic scrap. Attempts to pull the old Ham Radio trick of begging broken TVs from repair shops failed (somebody was buying these) but I was able to get six used VGA monitors from a local secondhand PC shop. These are a rich source of small signal transistors, trimpots, electrolytic caps, and ceramic caps. W1FB specifies NPO caps, which I was ignorant of before. The VGA monitors are a decent source of these, easily spotted (once you know what to look for) by their black stripes. I have not been able to get this receiver to work. The 4k/600 ohm transformers for this one were back-ordered for a while. One big question — a value for C3 is not specified.

Ramsey 80m Receiver. While on the subject of things not available, I ordered a Ramsey 80 receiver from their Web site. I got a nice call the next day saying these were out of stock. I remembered that AES stocked them, and got one in a few days. This one went together in a flash, and worked the first time. The tuning is a bit touchy, so I am going to substitute a multiturn pot like the Small Wonder units have. Some local AM tended to get into this rig, which was greatly reduced with my antenna tuner front-ending it. I was pleased to see the use of pots and varactor diode–type tuning. I am learning to hate variable capacitors, due mostly to obsolescence and short supply issues. I did order a 30m version of this receiver from Ramsey, and a matching cabinet. I found a 10.140 MHz crystal in an old CB, and want to get on this band.

Looking ahead, the Norcal QRP site has a new 10m surface mount kit. They have a warning as well that we need to get to know about surface mount technology, as the through-hole devices are going away. I only have one concern here — I find I can install surface mount devices, but do have trouble removing them without ruining them.

I think that once you build a few projects, and get them working, you can tackle almost anything. The local Minnesota QRP Club had a contest for an 80m transceiver design. I was interested a few months ago, but not in a position to compete. After a few more months, and few more projects, who knows?

[P.S. We thank quite-sane (we hope) NY9D for putting up with this article title in the spirit in which it was intended, fun. — ed.]

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Small Wonder Labs, Dave Benson

Continued on page 58

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Bookbind THIS! — Part 1

Get organized, and save money, too.

What do you do with all of your technical publications such as 73 Amateur Radio Today? *Do you stack the publications on a shelf, stuff them into a box, or throw them away? Are you aware of the valuable information that has been imparted on the pages of each issue placed into your hands?*

Hams, above most others, communicate technical information via schematic diagrams. Schematic diagrams carry the concept of a project design and techniques for achieving a useful piece of equipment. Unless the various issues are cataloged and stored where they can be found, the valuable information is essentially lost forever.

Not everyone can afford to have a huge library room available to them. I suffered from attempting to store the various publications on a shelf, and soon ran into a dilemma of disappearing storage space. To solve the problem at my house, I started binding the publications into annual volumes and then placing them in an organized fashion onto the same shelves. To save space with each annual volume, it was necessary to remove and save selected parts out of each issue before rebinding it into a volume. Each volume is marked with the magazine title and the publication year so that it will be easily identified.

Although the process steps for binding publications is simple and without surprises, it takes longer to describe the process than it actually takes to implement all of the steps. As a result, the bookbinding process has been broken up into three parts. I've included a number of pictures and diagrams in an attempt to make the techniques clear without anyone having to guess. In addition, a listing of the process steps is provided in the sidebar. Although this procedure works well, please understand that the approach I've outlined here is only one of many ways to accomplish the task, so you are encouraged to experiment to find a technique that works for you. The important thing to remember is that valuable information must be saved.

Perhaps the biggest inhibitor in any "new" process is the tool inventory required to make the process work smoothly. The tools that I selected for my use were drawn from what I had on hand for doing woodworking projects. Perhaps the only two "critical" items are the wood rasp for trimming the stem and the padding compound used for gluing the pages of the new volume. The wood rasps that I use have very sharp teeth that cut bound paper easily without tearing. I've used other types of wood shaper tools with some success, but really prefer the rasp.

Material and tools

Materials used in the bookbinding process are basically three items: kite string, padding compound (pad cement), and manila folders. Except for the padding compound, the other two are very common. **Photo A** shows the tools and padding compound used in my process.

A nonwaxed kite string is used to

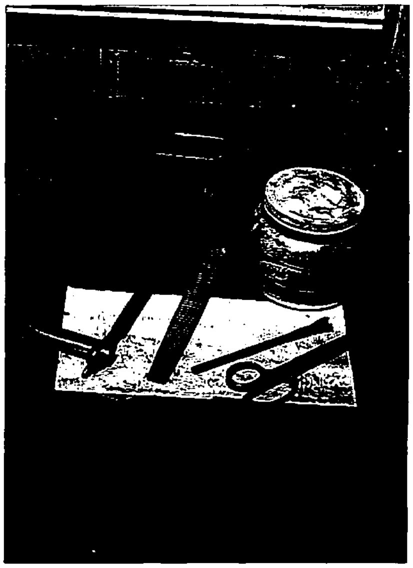

Photo A. *Needed tools and pad cement.*

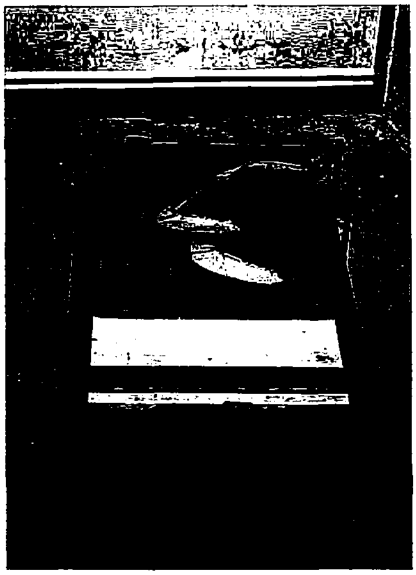

Photo B. *Clamping fixture, clamps, and weights.*

provide mechanical strength to support the glued stem. To "test" the string for suitability, lay a short piece in water. If water is absorbed into the string, then it is suitable for this process.

I've tried several types of glue to hold the "new" volume together, but prefer the use of padding compound, also known as pad cement. The compound dries as a clear, flexible, and tough binder that adheres to the paper pages. I've used "white glue" for gluing the book stem with success. But the drawback showed up a few years later when the white glue became hard and would crack when the book was opened up fully. Otherwise, it certainly did the job. Padding compound/cement is available at most bookbinding operations and at suppliers of bookbinding materials. I've found that one quart of compound will last me several years.

After the "new" volume has been glued, a new cover is placed around it. The material that I've been using successfully for cover material is called Index Bristol. Most people recognize the material as a "manila file folder." The typical and preferred size is 8-1/2 x 11 inches with a "straight cut" (no notches or tabs). The advantage of the new cover is that it adds very little to the total volume, but dresses up the new volume and provides additional strength to the glued stem. Straight-cut file folders work well for the majority of volumes that do not exceed about one inch in thickness. If the new volume exceeds one inch, then a sheet of material larger than a file folder may be required. Large sheets of Index Bristol in various sizes can be obtained through most stationery stores that provide customized ordering. The typical size sheet that I've found useful is approximately 26 x 32 inches. Each sheet can be cut down to cover three large/thick volumes.

Tools used in this suggested bookbinding process are assembled from "what's available" in the woodshop. The wood rasp is perhaps the most critical tool of all because it is "key" for trimming the binding stem of the volume. Wood rasps are available in most hardware stores.

Here is a listing of the tools and aids that I've found useful:

- Wood rasp
- Large "C"- or wood clamps
- Hacksaw, metal cutting blade
- 3/8"-wide acid brush, or equivalent
- Scissors
- Vacuum cleaner with hose and narrow pickup nozzle
- Sharpie™ black marking pen, fine tip
- Wooden pencil, #2
- Misc. weights
- Flat bar, wood or metal

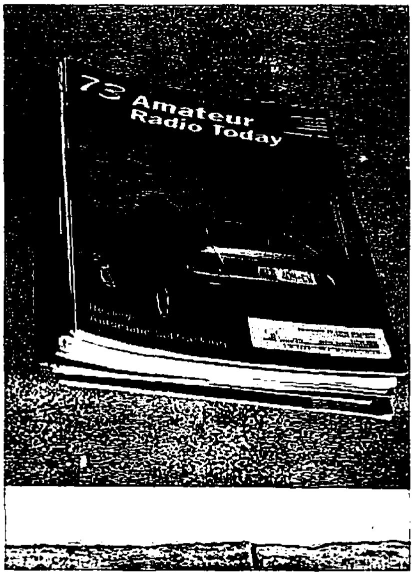

Photo C. *Twelve issues stacked in month order — January on top and December on the bottom.*

Bookbinding Steps

1. Collect and sort magazines into stacks of annual issues.
2. Stack issues from December (bottom) to January (top).
3. Tie stacks with string until ready to tear them apart.
4. Tear each issue down into individual pages.
5. Thin each issue for parts to save and those to discard.
6. Tie completed stack with string until ready to bind.
7. Adjust binding fixture for narrowest page.
8. Place one page at a time into the binding fixture.
9. Clamp the volume.
10. Rasp the stem to make all pages equal width.
11. Saw slots into the stem for string.
12. Cut notches into the stem to ensure capturing all pages with glue.
13. Vacuum to remove paper dust.
14. Tie string into the sawed slots.
15. Scrub glue into the string and paper.
16. Remove the volume from the clamps.
17. Select a cover for the volume.
18. Crease and fold the cover to fit the volume.
19. Apply glue to the volume stem.
20. Insert the volume into the cover.
21. Drop-impact the volume to seat the volume into the cover.
22. Place the volume in clamps while glue is drying.
23. Using scissors, trim the cover to fit the volume.
24. Mark the cover.
25. Crease and open the new cover.

• Wood for making clamping blocks/fixture

A word about the flat bar is in order. The bar that I've been using is a large, flat mill file that I happened to find at a swap meet. Because of the length and stiffness, it has been an ideal bar for holding the top side of the volume during clamping. **Photo B** shows the clamping bar, clamping block, clamps, and miscellaneous weights. Alternate "bar" materials will also work. Wood, and aluminum or steel angle stock are suitable materials for a bar. If wood is selected, Douglas fir, oak, ash, walnut, etc., are the better choices and will work well if the thickness is greater than 1/2 inch. Stiffness is the key, to reduce the tendency of bowing while under clamping pressure.

Beginning steps

The first step in the process is to collect all of the annual issues of a given publication and stack them face up, with the December issue on the bottom and with January on the top. A length of kite string is loosely tied around the stack to keep it organized in preparation for the tear-down step. Step two involves separating the issue page by page until the annual volume has been completed. Again, a length of kite string is placed around the loose volume pages to keep them organized until the binding process has begun.

Part 2 of *Bookbind THIS!* will discuss the types of bindings that a ham is most likely to encounter with various publications, the steps involved with separating the pages, and "thinning" out the volume for saving shelf space.

Part 3 of the series will discuss the process for binding and gluing the volume, followed by the marking of the new cover for the new volume.

Take advantage of the opportunity to save all of the valuable electronic information that has been placed into your hands. Utilize the bookbinding process as a stepping-stone for recovering shelf space and saving valuable knowledge in an organized manner.

[Here's a simple book shelving riddle for a likely harmonic or maybe even your next club meeting. If you take a year of 73 *(12 issues of 64 pages each) and put the issues on a shelf in normal left-to-right monthly order, how many pages will there be (excluding covers) between the first page of January (don't count that) and the last page of December (don't count that, either)? — J.B.]*

Answer to Bookbind This! riddle: Easy, huh? 12 x 64 = 768, less 2 (Jan. first page, Dec. last page) = 766. WRONG — Guess again!

The correct answer is 640. Remember, the first page of the January issue sits to the right of all other January pages on the shelf, just as the last page of December sits to the left of all other December pages on the shelf. So the January and December issues are effectively excluded from the count. Thus, 10 x 64 = 640.

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Guessless Beam Pointing

This has been around for years, but for you newcomers ...

It would be hard not to notice the improving conditions on our HF bands. During the next few years, contacts around the world will be easy to make and signal strengths will be very high. Working DX will be possible with "barefoot" rigs and simple antennas such as dipoles and verticals.

A beam antenna can do a much better job however. For example, a three element yagi beam can show about an 8 dB gain over a 1/2 wave dipole mounted at the same height, or a power ratio of about 6 to 1. In other words, a 100 W station with a 3 element beam will sound like a 600 W station using a dipole, and the beam will make just as great an improvement in receiving. All gain antennas such as yagis, quads, and phased arrays provide significant improvements to both your transmitted signal and to your receiving capability.

Most dipoles are in a fixed position, and their directions of maximum radiation are not easily changed. A rotatable beam, though, can concentrate your radiated power in the direction you desire — just point it toward the station of your choice.

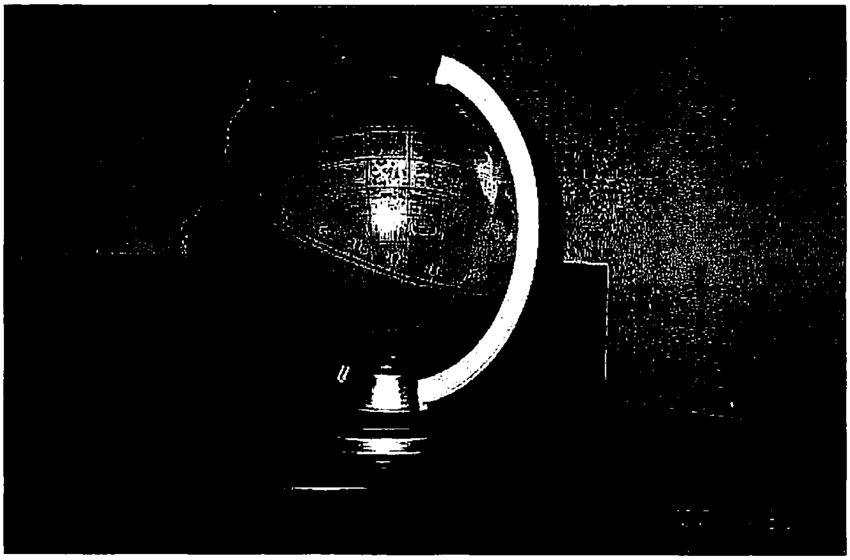

***Photo A.** This globe gives accurate bearing information to any place in the world from my present QTH in southern Illinois.*

When you are out hunting, you aim your gun at the squirrel, rabbit, bird, or whatever. How can you accurately point your beam at a DX station you can't see? There are computer programs available which can tell you the true bearing or direction from your QTH to major world locations — referenced to true north. Since about 1960, I have been using modified desk-size globes of the world to show me where to point my beams both quickly and cheaply. See **Photo A**. This particular globe is one I modified for my dad back in the mid-fifties, while I was home on leave from the Air Force. It's not very fancy looking, as I had no "press-on" lettering available then to give it a more professional look. It does give accurate bearing information to any place in the world from my present QTH in southern Illinois. The following instructions are valid for locations in the northern hemisphere. If your QTH is south of the equator, you must modify the procedures accordingly.

While a standard globe can usually be rotated around its North Pole/South

Pole axis, the modified globe has a new axis of rotation and is not usable at other QTHs more than a few miles away. The modification requires the axis of rotation to be changed to one that passes through the location of your QTH and through a point on the opposite side of the globe. Most of the cheaper desk-size globes have mounting systems that are flexible enough to allow the supporting pivots to be removed from their North Pole and South Pole bearings. Then, a pivot hole, the same size as the original North/South pivot holes, must be drilled at the location of your QTH and another one on the opposite side of the globe. The exact location of this second hole should be determined accurately to ensure smooth globe rotation as well as directional accuracy. The easiest way is to take advantage of the latitude and longitude markings on the globe. Latitude is simply measured from the Equator (latitude zero degrees) to the North Pole (latitude 90 degrees north) and, similarly, from the Equator to the South Pole (latitude 90 degrees south).

My QTH is located at about 38 degrees north latitude/88 degrees west longitude. The latitude of the opposite hole will be 38 degrees south latitude. The desired longitude of the opposite hole is not so readily apparent. **Fig. 1** represents the Earth as viewed from an imaginary point directly above the North Pole. Longitude is measured from the Greenwich, or Prime meridian, eastward and westward to a line of longitude exactly opposite the Prime meridian. East longitude then is measured from zero to 180 E and West longitude similarly measured from zero to 180W. (The 180W and 180E lines of longitude coincide and represent the International Date Line, although adjustments have been made locally to satisfy political desires.)

As shown, the 88 degree west line of longitude, from my QTH through the North Pole, turns into the 92 degree east line of longitude on the other side of the pole. Note that these lines are 180 degrees apart. So, for my QTH, the desired location of the opposite pivot hole will be 92 degrees east longitude/

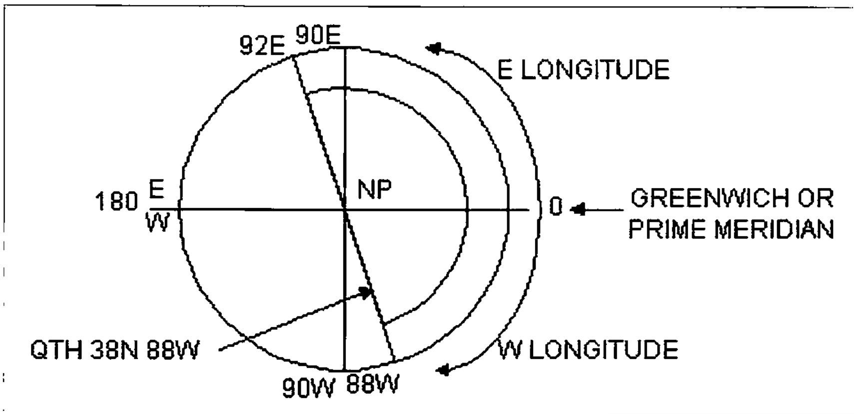

Fig. 1. This represents the Earth as viewed from an imaginary point directly above the North Pole.

38 degrees South latitude. I marked this point and drilled the second pivot hole at that spot. Your new pivot hole positions should be calculated using the latitude and longitude of your QTH.

Now reassemble the globe to the mount using the new pivot points. Looks strange, doesn't it! The upper pivot point now is at your QTH rather than the North Pole. Most globes have a pivot support system in the form of a semicircle. This semicircle is usually calibrated in degrees of latitude north and south of the Equator (which is marked with a zero); the North Pole is at 90 degrees, as is the South Pole.

Hold a pencil or Magic Marker against this semicircular support at the zero (0) position, or midpoint, in such a way that the tip of the pen/marker just touches the globe proper. Now, rotate the globe through 360 degrees, leaving a trace completely around the globe. This is your new artificial equator. For a more professional look, use a pencil to make this line and then use PC artwork as an overlay to produce a smooth line. Next, rotate the globe until the empty pivot hole that

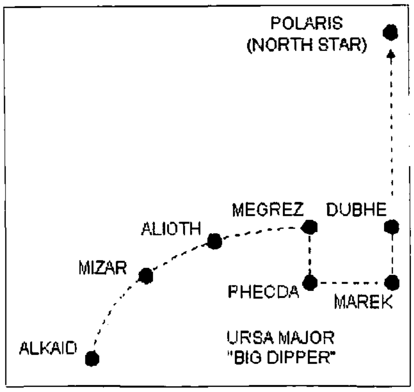

Fig. 2. The Big Dipper and its relationship to Polaris.

had represented the North Pole just lies under the semicircular support arm. Mark this point on the artificial equator — this now represents the direction of north, zero degrees or 360 degrees.

Repeat this with the pivot hole that represented the South Pole. This mark will represent the direction of south, or 180 degrees. Now rotate the globe until the new artificial equator intersects the real Equator somewhere to the west of Africa. A mark here will indicate the true direction of 90 degrees, or east. Repeat for the intersection of the artificial equator and the real Equator somewhere west of Hawaii. This point will mark the direction of 270 degrees, or west.

The location of markings for the bearings between 0 and 90 degrees will have to be determined by measuring the distance between 0 and 90 degrees along the artificial equator and dividing it into 6 equal segments which can be used to mark the 15, 30, 45, 60 and 75 degree positions. In a similar fashion, mark the segments between 90 and 180 degrees, 180 and 270 degrees and 270 and 360 degrees. Use rub-on lettering or Magic Markers to highlight these bearings.

Rotate the globe until Central Europe is under the support arm and then read the number on the artificial equator behind the arm. From my QTH, this bearing reads 45 degrees and is the direction I point my beam for most European DX. When I first used this globe system, I was surprised to find that South America was not to my south but more to the Southeast. This is an easy-to-use system to determine the true bearing to any place in the world. Just rotate the globe until the country of choice lies under the support arm (now the cursor), and read the bearing from the artificial equator line. The main problem remaining is to ensure that your beam and rotator can accurately position your antenna to the correct direction/bearing.

Once you know where the beam is to be pointed, you should make sure that your beam is mounted properly so that the rotor control meter displays the beam heading accurately. At zero, north or 360 on the meter, the beam should be pointing directly toward the north geographic pole. An easy way to locate true north is to use the star "Polaris," often called the North Star. Polaris is within one (1) degree of true north and is quite visible in the Northern Hemisphere. It can be located by using the stars in the Big Dipper (Ursa Major) as guides. The Big Dipper and its relationship to Polaris are shown in **Fig. 2**. (The Big Dipper will change positions during the year, but the pointer stars will always point to Polaris.)

Imagine a straight line from Marek through Dubhe and beyond. The first bright star that this imaginary line intercepts will be Polaris, the North Star. City lights may make Polaris hard to find. If so, a late night or early morning observation might be necessary. When you locate Polaris, stand at the base of your tower and find a suitable landmark directly between you and Polaris. This gives you a permanent reference toward true north, usable in the daylight when you will probably be adjusting your beam. Adjust your beam mounting arrangement so that the beam points toward this landmark when the rotor control meter reads "Zero," "North," or "360." Your rotor control system will now be about as accurate as possible.

If you find it impossible to see Polaris from your QTH, a couple of alternative ways to determine true north are available. For one, many towns and cities have their streets laid out in a north-south and east-west pattern. If applicable, use a N-S street as a pointer to find true north. Your city engineer should have reliable information on the street layout in your town.

Also, a good magnetic compass can be used to find true north. Unfortunately, the north magnetic pole to which a compass needle points is not located at the north geographic pole. Local magnetic anomalies also effect magnetic compasses. The difference between true north and the direction to which a magnetic compass needle is pointing is called "magnetic variation" and this varies from location to location. Magnetic variation is shown on many maps as dashed lines, each marked in degrees and identified as east or west variation. These lines are known as isogonic lines or lines of equal magnetic variation. Interpolation must be used to find the variation at locations between adjacent lines. When variation is "east," magnetic north is east of true north. When variation is "west," magnetic north is west of true north. At my QTH, the variation is 4 degrees east, which means that a magnetic compass here will point 4 degrees to the east of true north. So I would have had to make a 4 degree adjustment to use a magnetic compass. Many sport and military compasses are available that have an adjustable bezel or sight assembly that permit offsetting the compass reading by the amount of local variation (±).

Accurately determining the direction to the stations of your choice and then pointing your beam in that direction will maximize your chances for DX contacts, as well as permit more solid stateside QSOs.

Calendar Events

Listings are free of charge as space permits. Please send us your Calendar Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the May issue, we should receive it by March 31. Provide a clear, concise summary of the essential details about your Calendar Event.

MARCH 10

KNOXVILLE, TN On Saturday, March 10th, the Shriner/Hams of Kerbela Amateur Radio Service will sponsor their annual Hamfest at Kerbela Temple, 315 Mimosa Ave., Knoxville TN, 8 a.m.–4 p.m. Admission is $5. Indoor vendor tables are $8 each plus admission of $5. Setup Friday from 4 p.m.–8 p.m., and Saturday 5 a.m.–8 a.m. Overnight security will be provided. Talk-in on 144.83 (T)/ 145.43(R); or 146.52 simplex. Smoking indoors is permitted in designated area only. Contact *Paul Baird K3PB, 1500 Coulter Shoals Circle, Lenoir City TN 37772. Tel. (865) 986-9562.*

SCOTTSDALE, AZ The Scottsdale ARC hamfest will be held starting at 6 a.m. at Scottsdale Community College, 101 North - Exit Chaparral Rd., 9000 E. Chaparral Rd, Scottsdale AZ. Parking $2. Tables $10. RV parking. VE exams. For more info, contact *Roger Cahoon KB7ZWI, 8501 E. Edward, Scottsdale AZ 85250. Tel. (480) 948-1824. Mobile (602) 725-7256; Fax (602) 943-7651. Send E-mail to [rgcahoon@msn.com].*

MARCH 10, 17, 21, 29, APRIL 17

ST LOUIS, MO Three FREE all-day Severe Weather Observation training seminars are planned at various locations around St. Louis County. All are welcome, including those from outside the area. Free parking. Certification provided for R.A.C.E.S. and SKYWARN, all at no cost. At most locations, SKYWARN Level 1 Training is presented in the morning, and classes resume in the afternoon with the SKYWARN Level 2 Program. Training will be held as follows: Saturday all-day classes on March 10th, 17th and April 7th. Evening classes (Level 1 only), on March 21st and 29th. For locations call the *Severe Weather Info Line, (314) 615-7857,* for a taped message and additional information.

MARCH 11

AMHERST, MA The Mount Tom Amateur Repeater Assn. will hold its 16th Annual Amateur Radio & Electronics Flea Market on Sunday, March 11th, at the Amherst Regional Middle School, 170 Chestnut St., Amherst MA. From Exit 4 on Mass Pike, take 91N to Exit 18, Rte. 9, take Rte. 9 North to Amherst Center. Left onto Pleasant St., right on Main St. at third traffic light. High St. on left. Talk-in on 146.94(-) Mt. Tom rptr. Doors open at 7 a.m. for vendors, 9 a.m. for bargain hunters. Amateur and commercial license exam session at 10 a.m. Refreshments, 120 VAC, plenty of parking, help loading and unloading, handicapped accessible. Tables $15 each. Tailgating $5. General admission $5 per person, under age 12 free. See the Web site at *[www.mtara.org].* Contact *Cindy Loiero K1ISS at [n1fi@arrl.net, or (413) 568-1175* for table or exam reservations and additional info.

MARCH 18

JEFFERSON, WI The Tri-County ARC will present "Hamfest 2001" Sunday, March 18th, at the Jefferson County Fairgrounds Activity Center, Hwy. 18 West, Jefferson WI, 8 a.m.–2 p.m. Vendors will be admitted at 7 a.m.; others at 8 a.m. only. Vendors only parking will be provided for unloading. Talk-in on the 145.49 rptr. Admission $4. Table space, 8 ft., $6 each. Reserve your space early. Contact *TCARC, 213 Fred- erick St., Fort Atkinson WI 53538. Tel. (920) 563-6381 eves.; FAX (920) 563-9551. E-mail [tricountyarc@ globaidialog.com].*

MAUMEE, OH The 46th Annual Hamfest/Computer Fair of the Toledo Mobile Radio Assn. will be held 8 a.m.–2 p.m. at the Lucas County Rec. Center, 2901 Key St., in Maumee. For details, send an SASE to *Paul Hanslik N8XDB, P.O. Box 273, Toledo OH 43697-0273. Tel. (419) 385-5056; Web page [www. tmraham radio.org].*

MARCH 24

ST. PAUL, MN The Robinsdale ARC, Inc. will host its 20th annual Midwinter Madness Hobby Electronics Show at the Gangelhoff Center which is located on the Concordia University campus in St. Paul. VE exams 8:30 a.m.–3 p.m. Super buys on computers, hardware, components, peripherals, and amateur radio equipment. Admission is $7 at the door. Contact *RARC, P.O. Box 22613, Robbinsdale MN 55422; or call (763) 537-1722.* Check the Web site at *[http://www.visi.com/~k0ltc].* Send E-mail to *[kØltc@visi.com].*

MARCH 25

MADISON, OH The Lake County ARA will hold

Continued on page 58

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Lessons From a Long Drive

We are indeed a mobile society, as I experienced recently with a move from the southeast to the midwest to start my new career with the Nebraska Health System. Amid the preparations to prepare our house for sale and pack those things I would need to take with me in advance of the movers, I tried to look at the bright side. At least the drive from Florida to Omaha would give me some radio time.

The three-day, 1,500-mile drive would give me ample opportunity to get in some operating time on both the HF bands and more than a few repeaters along the way. While I did get in some time, freezing rain and heavy snowstorms dictated that a significant amount of my time and attention be given to my driving rather than to the radio.

Nevertheless, I was able to make some contacts along the way and make a few observations. APRS was active, and I had programmed a series of repeater frequencies into the Kenwood TMD-700A. I intended to operate some HF during some of the longer stretches of the drive, especially where I did not expect much 2-meter activity.

Mobile HF operations are a bit different for a variety of reasons. We operate with limited power, a modest antenna, and limited band options. I have always been more successful at answering someone else's call than calling CQ myself. This means that I tune the band and listen in on what's happening. I had my resonators for 10 meters and 20 meters on the Comet CA-HV antenna and bounced between the two bands as time permitted. I was traveling during the week, so the stations I heard on the HF bands are probably quite a bit different than those I normally hear on evenings and weekends. I don't know if it was a bad day, the phase of the moon, or what, but I do have to admit that I was actually embarrassed by what I heard. In fact, I turned the rig off on several occasions because I had no desire to listen to what was going on.

On the other hand, I had delightful chats with several people on two-meter simplex. The people were polite, interesting and engaging. I couldn't help but think about all the brouhaha that surrounded the elimination of the code requirement for the Technician class license and last year's license restructuring. As you may recall, many worried that these newcomers might ruin the hobby if we no longer had code as an entry requirement. While these fears proved groundless, I wonder if perhaps the opposite is true.

As I mentioned, both the courtesy and the quality of the subject matter were significantly higher on two meters than on HF. Many of these contacts mentioned that they were Technicians and we discussed a wide variety of topics and interests. Incidentally, some of the most intelligent conversations I had were with new hams who were teenagers. These conversations certainly made my trip far more enjoyable. We've all read articles stressing how important it is for the survival of the hobby to get younger hams involved. Getting younger people interested in the hobby may not only benefit the hobby and promote its growth, but may also lead to more interesting QSOs. It seems as though the younger folks are more open-minded, with a wider range of interests.

On the other hand, some of the HF operators I heard (who sounded old enough to know better) elicited no desire for me to pick up the microphone. In fact, it has forced me to offer the following unsolicited advice. I understand that those who read it seriously are probably good operators already and don't need it. Likewise, those at whom it is aimed will assume it is meant for someone else and either ignore it or get surly.

When I was much younger I was taught that in polite conversation one should avoid sex, politics, and religion. I tend to believe that this still holds true on the radio. Let's just say that many of the topics and much of the language I heard on 20 meters, while certainly legal, tended to reflect poorly on those involved in the discussion. There's a time and place for everything, but I'm not sure 20 meters and a kilowatt meets these criteria. Maybe the reason we weren't getting as many new hams into the field is that they listened in on the bands and decided against it. There are plenty of interesting topics to address in a hobby that is global in its nature. I find it hard to believe that constant complaining about everything that's wrong with the world is necessary, and I'm sure such diatribes convince some potential hams to look elsewhere for a hobby.

I seem to recall reading when I first was studying to get my license that no one can claim ownership of a given frequency. Nevertheless, there appears to be a misunderstanding about this concept wherein certain operators feel (notice I don't claim that they "think") that certain frequencies are their private domain. I've never seen the appropriate regulation that gives certain operators special enforcement authority to ensure that anyone invading "their" frequency is dealt with swiftly and harshly.

Similarly, there are operators who might be well advised to go back to their study guide and bone up on propagation theory. Remember the ionosphere and its D, E, F1, and F2 layers? As I recall, it is quite common for propagation to be different between stations. In other words, your low power signal may be reaching me quite strongly while my high power signal is reflecting in such a manner as to miss you completely.

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HOMING IN

Radio Direction Finding

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Your RDF Questions Answered

The snow will soon be gone across most of North America, and hams in every state and province will be emerging from their shacks to go on hidden transmitter hunts, both on foot and in vehicles. Will you be among them?

ARRL's Web site recently surveyed visitors about their participation in transmitter hunting, which is also called foxhunting and T-hunting. Over 2,400 Web-savvy hams replied, a respectable sample. About a quarter of them said that they did it occasionally or often. Is that true of the members of your local radio club?

On the other hand, 60 percent of survey responders had never tried Radio Direction Finding (RDF) contests of any kind. I wonder how that compares to other ham radio activities. The only clue at the ARRL's site was a survey of image modes, such as slow-scan and fast-scan ham TV. Almost 80 percent of responders said they had never tried them.

I have urged you to enjoy this exciting part of ham radio in the pages of this magazine for over 12 years. My Web site has promoted it for almost five years. The response has been gratifying. Lots of hams and nonhams want to know more. Not surprisingly, many of the inquiries are the same. This month, I'll let you in on the most frequently asked questions about RDF, and the answers.

Getting Started Is Easy

Many newcomers overestimate the difficulty of putting on their first event. They ask: "My club wants to start transmitter hunting, but first we need a hidden transmitter. What is available?"

Before you can pick the proper tools for any job, you have to evaluate the job. Just as no screwdriver is perfect for every size screw, no hidden transmitter setup is ideal for all situations. Hiders use a wide variety of equipment. Power output and antenna type depend on the distance to the start point and the level of intended difficulty. Discuss with your club whether you want to do short-range on-foot hunting, longer-range hunting on bicycles, or still-longer-range mobile hunts. Inquirers seldom tell me this in the first E-mail.

For your club's first mobile hunts, keep it simple. Have the hider stay with the transmitter and key it up at appropriate intervals. He or she can read into the mike from a book or from the club newsletter, or just make comments and urge the hunters on (**Photo A**). A starter hunt like this is a great way to end the weekly club or ARES net on your local repeater. With lots of folks listening then, you're more likely to get some of them to come out to find the T. Make sure to remind everyone to do their RDF on the repeater input frequency, not the output!

After a few hunts, you may want an unattended transmitting setup so that the hider doesn't have to stay with the rig. You could connect your two-meter hand-held or mobile transceiver to a tape recorder, playing an endless loop answering machine cassette with an appropriate message or sound effects, plus station ID. Some prefer to hide a dual-band hand-held and activate it on the subband from another transmitter.

Later on, after you gain some experience and have a better idea of your particular needs, consider a dedicated foxbox with tones and a cycling timer for hiding (**Photo B**). You'll need five units like this for on-foot hunts under international rules. I covered foxboxes in detail in "Homing In" for March 1998 and in my book on RDF. (*Transmitter Hunting — Radio Direction Finding Simplified* by Moell and Curlee is published by TAB/McGraw-Hill, ISBN number 007-1560068.)

Popular transmitter controllers for both mobile and on-foot foxhunts include PicCon by Byon Garrabrant N6BG and the Montreal Fox Controller (MFC) by François Tremblay VE2JX and Jacques Brodeur VE2EMM. See "Resources" for more information. Advanced hunts with unattended transmitters are best on simplex frequencies, where they can't accidentally QRM repeater QSOs.

Miniature transmitters bring almost endless fun to advanced mobile hunts. In December's "Homing In," I told you about an informal contest in the San Francisco Bay area to see who could make the smallest fox transmitters. At that time, one ham had a

***Photo A.** A hidden transmitter setup doesn't have to be fancy. David Bunger NØQEC and Daniel Cowell KBØIEK of the Lincoln (Nebraska) Amateur Radio Club await the hunters as they read from my book into the mike. Note the transmitting beam antenna affixed to the sawhorse.*

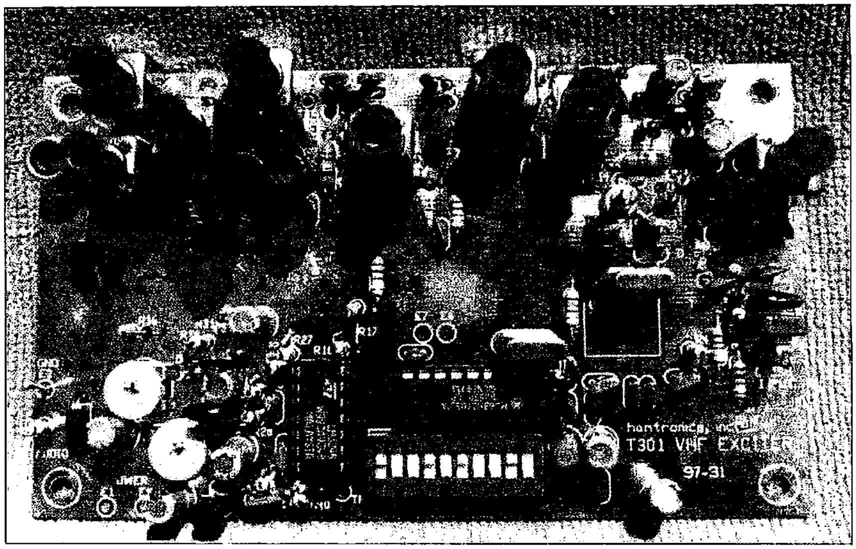

Photo B. VHF transmitter boards like this two-watt synthesized model (T301) from Hamtronics are ideal for medium-power foxboxes in surplus ammunition cans. They produce clean output when driving high-power amplifiers, if needed.

transmitter, battery, and controller that fit into a 35mm film canister. In a recent E-mail, Paul Shinn wrote, "That is now considered to be big. The latest creation is dubbed the Micro Montreal Fox (MMF). It is almost half the size and puts out 60 milliwatts!"

Paul continues: "The MMF is built into a waterproof metal enclosure and is only slightly larger than a 9-volt battery alone. We also have a one-watt version in the works that will be about the size of four 9-volt batteries put together. The size is mostly for the lithium ion battery pack. The guys here like transmitters that stay on continuously and the hunts run for 4 hours, so that limits our miniaturization. Now, if we could just build a nuclear reactor that's the size of a pea!"

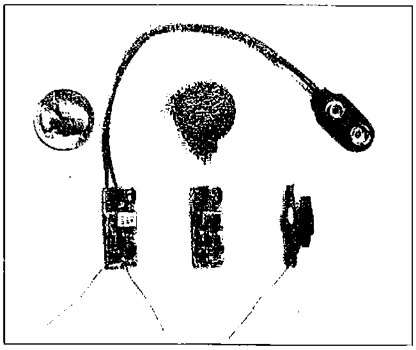

Photo C. Whether for sport or for covert tracking, the biggest part of a tiny hidden transmitter is sometimes the battery. These transmitters, designed by Ken Bauer of Airtek, were featured in previous "Homing In" columns.

Do-It-Yourself 007 Tricks

Question 2 is by far the most frequently asked, because it comes from both hams and nonhams: "I need a miniature transmitter to put on my prized possession to find it when it wanders away, or is stolen or abducted. What is available?" The "prized possessions" in these inquiries have included sports cars, TV sets, motorcycles, cats, coonhounds, and many other things, living or inert.

A stamp-size microtransmitter project was featured in "Homing In" for May and September 1993 (**Photo C**). This 25 milliwatt crystal-controlled rig was designed by Ken Bauer KB6TTS and can be tuned for either the 2-meter or 125-centimeter ham bands. Surface-mount construction isn't for everyone, so Ken's company, Airtek Engineering, also makes wired/tested transmitters. His primary market is hams who fly model gliders, to aid in their recovery.

I always remind inquirers that transmitters on ham frequencies may only be used by licensed amateur radio operators, and that plenty of T-hunting hams are ready and eager to track down nonham intruders on these frequencies. Station ID and control operator requirements of FCC Part 97 must also be followed (**Photo D**).

Even a QRP transmitter has to be spectrally pure, because it may end up near an airport or other sensitive location. The second harmonics of a two meter signal are on frequencies used by aircraft! Hiders in southern California like to put their T's on top of mile-high mountain peaks, where a few milliwatts can cover thousands of square miles. There are some tiny transmitters being marketed to T-hunters that have not been reviewed by "Homing In" because my tests have shown them to be spectrally "dirty." Just as output filters are standard equipment in base and mobile ham transceivers, they should also be included in micro-T's, even if it means making them a bit larger.

There are several commercial suppliers of tiny transmitters and tracking receivers for the wildlife management market. They are also popular with owners of prized hounds. Magnum Telemetry, featured in "Homing In" for August 2000, is an example. Under FCC Part 15, these transmitters typically operate just below TV channel 7 or just above TV channel 13.

To save battery life, tracking transmitters are usually pulsed for a few milliseconds, about once a second. For RDF, most wildlife trackers use very sensitive receivers and beam or phased-array antennas. Special tracking receivers are expensive, but many users have had good results with ordinary hand-held scanning receivers. They should be multimode (including CW and SSB) models such as the Icom R-10, Trident TR2400, or Sony ICF-PRO80.

Most of the miniature "bug" transmitters that are advertised in experimenter magazines such as *Popular Electronics* and *Nuts and Volts* use the 88 to 108 MHz FM broadcast band. At first thought, it appears to be an advantage that they can be received on ordinary home and car radios. However, this means that effective range is limited by interference from powerful broadcast stations. Furthermore, modulation deviation in the FM broadcast band is 15 times greater than on two meters, and receiver bandwidth is correspondingly larger. This means that signal-to-noise ratio is degraded and that FM broadcast receivers are incompatible with narrowband Doppler RDF sets.

Attaching your own tiny transmitter and antenna means that the thief who takes your prize-winning feline can get it out of your detection range very quickly, or simply put your tabby in a car trunk to shield the signal. By contrast, commercial stolen vehicle recovery systems such as LoJack are effective because there are so many receivers in the service area that there is a good chance one will always be close by. In Los Angeles, over 400 squad cars are equipped, plus law enforcement helicopters and some fixed stations.

Kid Trackers, Too?

Some inquirers carry this concept a step further, asking: "I want a pager-sized

tracking device to put on my toddler. This would work with a pocket-sized receiver and RDF set so I could locate the child in case he or she becomes lost or abducted."

I often suspect that these writers are thinking not only of their own kids, but of the money-making potential of this technique. In either case, the tracking of children is a much more serious and difficult matter than the tracking of sports cars. Here are just some of the many factors that must be considered:

• Size — For sufficient transmitter power and antenna size to permit tracking over a wide area, the child's transmitting device must be bigger and heavier than most people would desire.

• RDF — An effective tracker needs a "wide aperture" antenna for sensitivity and accuracy, so it cannot be pocket-sized. However, parents won't want to haul around a big tracker.

• Battery Life — The longer the battery must last, the bigger and heavier the transmitter on the child must be.

• Antenna — How do you put an effective antenna next to a child's body without detuning the antenna?

• RF Radiation —Is it safe to have a transmitting antenna next to a child's body?

• Liability — Will the maker be sued if parents do not quickly find their child with the device?

• Security — How do you keep criminals from tracking other people's lost children? What happens if a potential kidnapper uses RDF to locate the lost child before the parents do?

My advice is to leave kid-tracking to the professionals, and don't try it at home. If it were straightforward and easy, lots of companies would be doing it. The tracking devices would be as popular as Razor scooters. But as of this writing, I don't know of any. Sure, there are occasional news stories about such systems that will be available "real soon now." But somehow they never gain widespread acceptance.

Most proposed and publicized commercial child-tracking systems don't use true RDF. Instead, they opt for GPS or other time-of-arrival (multilateration) solutions. The mention of GPS makes hams think of using APRS for this application. The pros and cons of that approach are beyond the scope of this article, but keep in mind that a GPS receiver doesn't work well inside a car trunk, either.

A similar but equally often-asked question calls for a different approach. There are many variations, but this is typical: "Our construction company is losing small tools, either by accident (such as falling into holes) or theft. Can a transmitter be inserted into items like wrenches, drills, or grinders, with a RDF unit capable of detecting them from outside a vehicle?"

RDF is typically done at considerable distance, from yards to miles and beyond. For that, transmitters require long-term power sources (such as batteries) and efficient antennas. Such an installation fits in a sports car or animal collar, but is too large to go into small items such as hand tools. In addition, the transmitted signal can be detected by anyone with a receiver tuned to the proper frequency, or even a frequency counter, so these systems are not covert.

RFID technology at the job site exit is probably more appropriate for this tool-detection application. RFID systems precisely track property and objects at relatively close range. For instance, chips (also called transponders) can be implanted in pets to provide positive proof of ownership if the pet strays into the pound or is stolen. A reader device, passed over the chip, detects it and reads out the chip's unique ID code. Similar RFID systems sound an alarm when non-paid-for merchandise passes through the doors of a store. RFID is done at greater distance in automatic toll collection systems. The FasTrack® transponders for new southern California toll freeways can even be used to quickly pay for a McDonald's burger at the off ramp!

The chips (also called tags or transponders) are usually passive, meaning that they don't require battery power. They cannot be detected with conventional receivers, but only by a reader or polling device designed to be used with them. For a quick introduction to transponder technology with some links, see the Radio Frequency Identification (RFID) Systems page at the Virginia Polytechnic Center for Wireless Communications Web site, listed in "Resources."

Wrong-Way Beams

The last question for this month hasn't actually been asked many times, but it should: "Can I use my two-meter yagi or quad for RDF on other frequencies, such as the aircraft band for Emergency Locator Transmitters (ELTs), or the VHF marine band?"

No! The directional characteristics of parasitic antennas such as yagis or quads change significantly when frequency is varied by only a small amount. I thought every ham knew this until I put on one of the first 223 MHz hunts in southern California a decade ago. It wasn't in a truly difficult-to-find place, but one hunter couldn't seem to

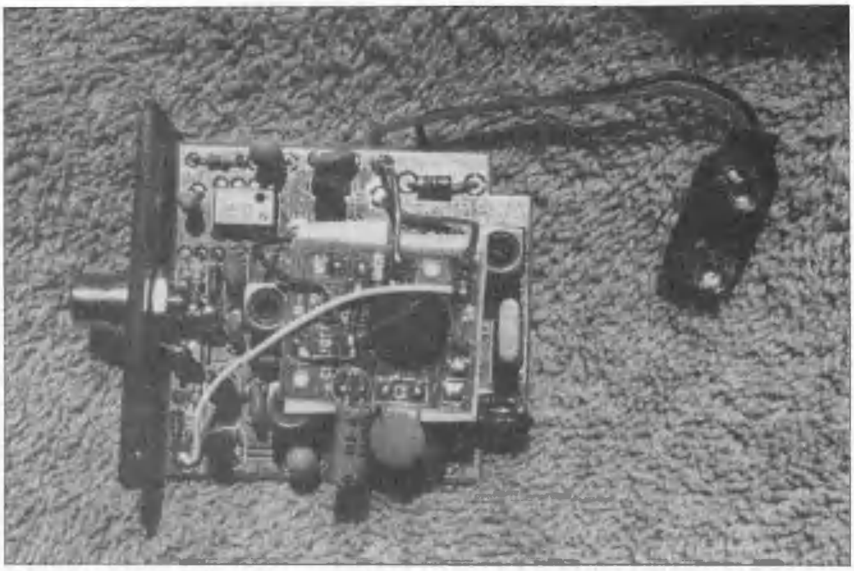

Photo D. You don't have to use surface-mount techniques to build a small two-meter transmitter. This cigarette-pack-size rig by Don Lewis KF6GQ was built around the Motorola MC2833 transmitter and 555 timer ICs, both in DIP packages. It puts out five milliwatts. The top board came from a voice-message greeting card, now used to generate audio modulation and station ID.

close in. Every time I talked to him, he was in a different spot that was equally far from my location.

Finally, I asked what equipment he was using for RDF. He replied, "My two-meter quad, of course!" I asked him to take a bearing on my signal and tell me what it was. Sure enough, it was off by almost 120 degrees!

Space for this month is almost gone, so I won't go into all the theory, but suffice it to say that a full-size VHF or UHF quad or yagi won't have full gain or directivity when used at more than plus or minus 3% of its design frequency. A shortened or loaded gain antenna (such as the Shrunken Quad in my book) is even more sensitive to frequency, with a usable bandwidth of one-quarter percent or less.

An Internet foxhunting mailing list recently had a message about hams in the state of Washington who discovered that their two-meter beams worked backwards when tracking 121.5 MHz ELTs. That's no surprise when you consider that the reflector of a 146 MHz beam is about the same size as the director of a 121.5 MHz beam. Similarly, an illustration at the "Homing In" Web site shows how a two meter beam "points rearward" when tracking 172 MHz wildlife transmitters, and has almost 8 dB less gain, too.

Incorrect feedpoint matching is another problem of off-frequency beams that usually doesn't appear in antenna design software plots. It results in additional unwanted pattern lobes and nulls, caused by interaction of the feedline pickup and beam response. Since it's easy and inexpensive to make yagis and quads with optimum dimensions and matching for any VHF/UHF frequency, take the time to do the job right (**Photo E**).

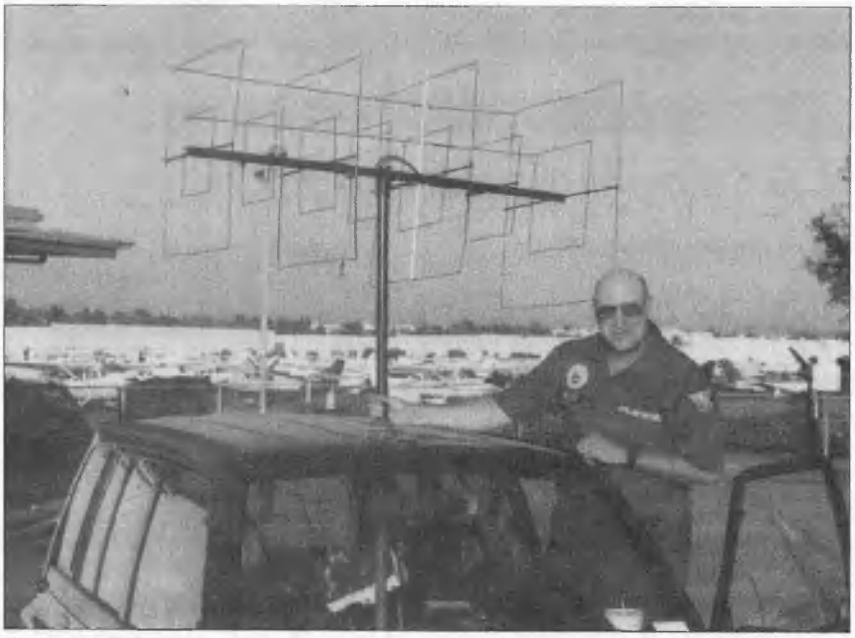

Photo E. VHF/UHF yagi and quad antennas must be operated within a few percent of their design frequency for best RDF performance. Bob Miller N6ZHZ of the Civil Air Patrol built this special cut-to-frequency dual-band quad for tracking weak aircraft Emergency Locator Transmitter signals on 121.5 and 243.0 MHz.

What's Your Question?

I enjoy corresponding with hams and clubs that are getting started in hidden transmitter hunting. But before you press the E-mail SEND button, check the "Homing In" Web site. The answer to your question might already be on the Frequently Asked Questions page, or somewhere else in the 30 subpages there.

Please don't get anxious if you don't get an immediate answer. If I can reply completely from information in my head or if I need more details from you, you'll probably hear back right away. But if I have to do any research at all, such as look up a Web site or magazine article reference to recommend to you, then your mail goes into the "to do" file and might take a while to emerge, especially if a business trip intervenes. Don't give up unless it's been at least a couple of weeks, then send me a reminder in case I lost your mail or it didn't get to me.

One of my greatest frustrations is to do the research to answer a specific question, then have the reply bounce back to me because the sender changed E-mail addresses or canceled his E-mail account. If you're not going to be at your return E-mail address for at least three weeks, kindly wait until you have a "permanent" address before sending your inquiry.

Continued on page 59

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More HW-9

Last time, we talked about the slipping VFO in the HW-9. I've received many letters and E-mails from readers telling me that those hints put several HW-9s back on the air. Let's hope this month we can get some more HW-9 QRP rigs operating.

The HW-9 is a very good QRP transceiver. However, it suffers from several problems. This month I'll take a look at some of these aliments and how to overcome them.

Low RF output

Besides the slipping VFO, the second most common problem with the HW-9 is low RF output on the higher frequencies. This problem is most notable on 10 meters and 12 meters. Sometimes, the 15-meter band becomes unstable, but has more than enough RF output.

To fix the instability problem, we need to look all the way back to the predriver. "From the factory," Heathkit used MPS6521 transistors (Heath p/n 417-172) for Q401 and Q402. These are the pre-drivers that drive transistor Q404. Q404 is a 2N3866 (Heath p/n 417-205) that is more than adequate in power gain and frequency. Now, if you have ever built a QRP transmitter utilizing a 2N3866, you can relate to this. That transistor has a wild side to it. If the circuit is not designed correctly, a 2N3866 will become an amplifier and an oscillator at the same time. Looking into the radio, you'll see there are ferrite beads on the base leads of Q401 and Q402. This indicates there are some instability problems.

The stability problem is not with the 2N3866 but rather the two predrivers, Q401 and Q402. In a nutshell: too much gain. The fix is to install something a bit tamer. For Q401, try a metal-cased 2N2222. Yup! And for Q402, a 2N3904 works. I've tried some 2N4401s, but was not impressed. I also tried MSPA20s and some 2SC1711s for Q401.

With 13.8 volts, my HW-9 produces about seven watts on 80 meters and about three and a half on 10 meters. I've heard some people talking about getting upward of nine watts out on 80 meters. Remember, the idea here is clean power, not just power.

That amount of power is quite high for a QRP radio. If you're long-winded, better check the temperature of the heat sinks on the HW-9's finals. Also, it's not a bad idea to install a heat sink on the 2N3866 as well.

I've talked to quite a few QRP ops, and one of the questions they have about the HW-9 is lack of power on the higher frequencies. The dropoff in power is especially noticeable on 10 meters. If you have done the fixes above and still can't seem to get 3–5 watts out on 10 meters, use your fingertip and gauge the temperature on the final transistor's heat sink. They both should be quite warm to the touch after a few minutes of key-down. If one takes the skin from your finger and the other one is stone cold, you had better order a replacement. The final transistors used in the HW-9 are MRF237s. You can get these from RF Parts, 435 South Pacific St., San Marcos CA 92069, 1-800-737-2787. E-mail: [rfp@rfparts.com].

Better voltage regulation

I did not sit in the design meetings when the HW-9 was being born. So, I don't know

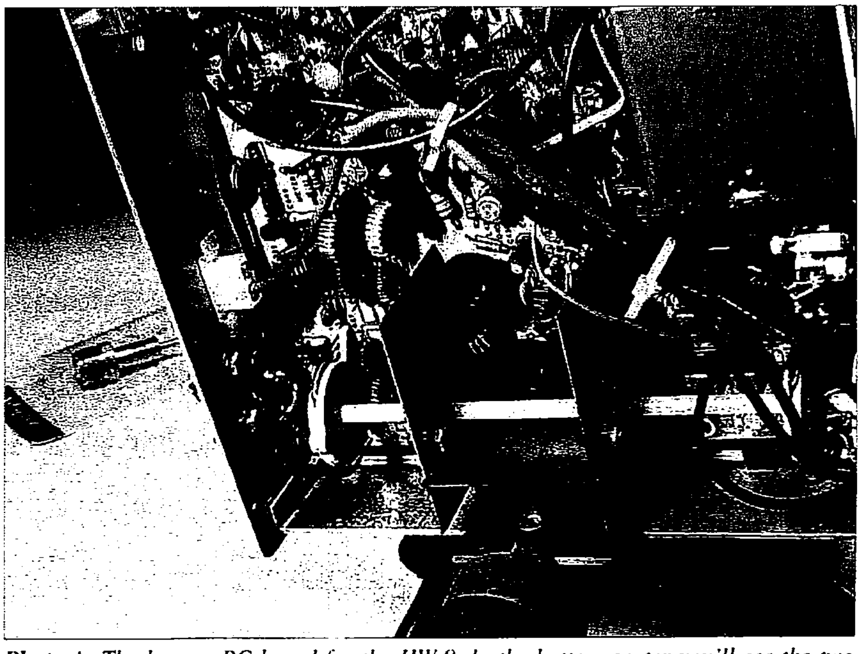


Photo A. The bottom PC board for the HW-9. In the bottom center you'll see the two black heat sinks for the final transistors. On the left of the finals you'll see the two empty slots for the filters. These open locations would be filled with the correct inductors needed.

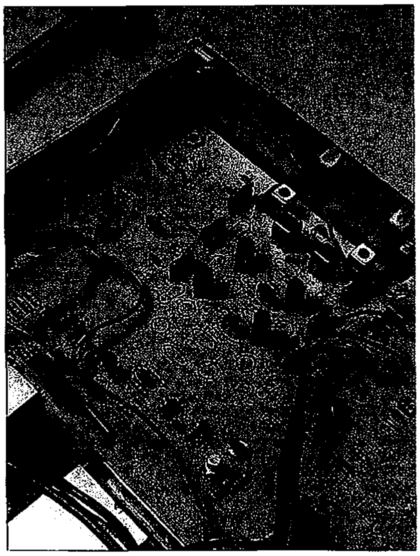


Photo B. The top PC board for the HW-9. Most of the mixer circuits are here. Also, note the large amount of unstuffed parts. Again, these were for the "band kit" giving the user the WARC bands.

why the engineers did not have the BFO and HFO oscillators run from the internal +9 regulated supply. Instead, the VFO and HFO oscillators are supplied by the unregulated voltage coming in from the outside world.

To improve the stability of the circuits that operate from the +9 volts, change U402 from a 78L08 to a 78L09 regulator, and replace D409 with a jumper wire. You'll see an overall improvement in operation. But the BFO and HFO are still running from an unregulated source. So, other than ripping up PC board traces, make sure you operate your HW-9 from a rather "stiff" power source.

Fixing the keying problems

The HW-9 keys way too soft. In fact, speeds over 25 wpm are hard copy. Most QRP ops use a keyer with a weight control to help stiffen up the keying on the HW-9. A better way is to change out some parts.

The first place to start is by removing C578, a 47 µF electrolytic, and replacing it with a 10 electrolytic capacitor. This shortens the trailing edge but affects the mute delay line. To fix this, change the value of resistor R444 from 180 ohms to 1500 ohms.

Try the HW-9 out again. If you find the LEADING edge of the CW waveform is too hard, change capacitor C435 from 2.2 µF to 4.7 µF.

Some audio improvements

In my HW-8 Hand*book*, one modification to improve audio was as simple as removing a capacitor and turning it around. You can do the same with the HW-9. Unsolder capacitor C336, a 2.2 µF electrolytic, and install it backwards for polarity. It should be reversed from what is shown in the manual, schematic, and PCB silk-screening.

Some operators have had improved audio by subbing a TL084C quad FET op amp for the LM324 used at U304. Since this op amp is in a socket, it only takes a few seconds to swap out. I can't tell any difference in my HW-9. But others say the change was well worth the effort.

While you're messing with the active filter, you might want to check the values of these parts: resistors R354 and R359 and capacitors C339, C341, C344, and C345. They should all be as close to value as possible. And as in any audio filter, only the best-quality parts should be used. Leave the cheap stuff in the junk box. The better the quality, especially the capacitors, the better the filter will perform.

Modifying the AGC loop

Some find the AGC a bit too fast for them. You can alter this AGC loop by changing the value of either C317, a 3.3 µF electrolytic, or increasing the value of R312. You might want to play with the values of these two components. You can alter the AGC by lowering the value of C317 or increasing the value of R312.

The HW-9 is a great radio. It's easy to work on, and has plenty of features. Aside from the problems (and what radio does not have a bug or two) listed above, the HW-9 would be at home in any QRP operator's shack.

Finding an HW-9

Although they were sold right up to the end, the Heathkit HW-9 still brings in lots of money on the used market. I don't know why, either. Depending on the options, such as power supply and WARC band kit, plan to pay from $200 up to $450 for one. An UNBUILT HW-9 on eBay went for almost $2000!

Every now and then, I've seen the optional band kit listed on eBay. These seem to hover at about $50 each. If you're handy with winding coils, you could hand-make the needed parts. You'll need to order the necessary crystals for the HFO oscillators for each band you want.

QRP ARCI FDIM: Don't miss this one!

This year, the Dayton Hamvention will be celebrating the 50th event. And again, this year the QRP ARCI will be holding their "Five Days in May" QRP bash. The last several years, it's been a sold-out affair. So, here is the info you need to reserve your seat.

"The QRP Amateur Radio Club International (QRP-ARCI) proudly announces the sixth annual 'Four Days In May' QRP Conference commencing Thursday, May 17, 2001 — the first of four festive days of 2001 Dayton Hamvention activities. Mark your calendar for these four days, and register early for this not-to-be-missed QRP event of the new century. Amateur radio QRP presentations, workshops, and demonstrations will be the focus of the full-day Thursday QRP Symposium to be held at QRP ARCI headquarters — the Ramada Inn Dayton South.

"Here is a brief overview of the four days:

"Thursday: QRP Symposium: 8:00 a.m.–4:30 p.m. Contribution: $15.00. Topics include: SMT Construction — George Dobbs G3RJV, and Interference to Amateur Radio — Ed Hare W1RFI. And more — monitor the QRP-F, QRP-l, and QRP ARCI Web site [http://www.qrparci.org/] for details on other presentations.

"Thursday Evening: Author Social, 7:00 p.m.–11:00 p.m. No charge. A chance to meet and talk with the QRP Symposium speakers.

"Friday Evening: Vendor Social — starting at 8:30 p.m. No charge. Friday evening has been set aside for QRP vendors. Here is a chance to eyeball the latest equipment and talk with the vendors.

"Saturday Evening: QRP ARCI Awards Banquet — 7:00 p.m. to 9:00 p.m. $25.00 per ticket. Advance tickets only, see Web site for details. Saturday evening starts with the annual QRP ARCI Awards Banquet honoring QRPers who have made major contribution to QRP and amateur radio. We will also announce the winners of the various 'build-it' contests. Fantastic door prizes, great speaker, tons of fun — be there.

"Later on Saturday Evening: Display of the building and design contest entries and winners, PLUS the Radio Show — FREE! Saturday evening provides time for QRPers to socialize with the QRPers from around the world. Show off your projects/collections at the Radio Show! All entries for the building and design contests will be on display. This year we have two general categories:

"1. Wide open category — bring your latest homebrew or kit project.

"2. The second contest is 'in the works.' Monitor the QRP-F, QRP-1, and QRP ARCI Web site [http://www.qrparci.org/] for details."

For more information, checkout the Web

site. It will be updated as more information is tied down. Hope to see you there.

April QRP Contest

Here are the rules for the April QRP Contest.

1. When: April 14 1200Z through April 15 2400Z, 2001. Work a maximum of 24 hours of the 36-hour period. CW only. Work station once per band.
2. Categories: All-band, Single band, High bands, Low bands, Multi-Op, DX.
3. Exchange: RST; State, Province, or Country (S/P/C); ARCI number (nonmembers, send power).
4. QSO Points: Member = 5 pts. Nonmember, different continent = 4 pts. Nonmember, same continent = 2 pts.
5. Multipliers: S/P/C total for all bands. S/P/C's count once per band.
6. Power: >5W = x1. 1–5W = x7. 250mW–1W = x10. <250mW = x15.
7. Final score = QSO points x Total SPCs x Power multi.
8. Suggested Frequencies (kHz): General — 1810, 3560, 7040, 14060, 21060, 28060. Novice — 3710, 7110, 21110, 28110.
9. Team competition: 2 to 5 members per team, or unlimited number of operators as long as a maximum of 5 transmitters on the air at a time. Compete individually as well as on the team. Team captain must send list of members to Contest Manager before contest.
10. Send QRP ARCI contest entries within 30 days of contest date to: Randy Foltz K7TQ, ATTN: Spring QSO Party, 809 Leith St., Moscow ID 83843, or E-mail ASCII-text entries to [rfoltz@turbonet. com].

Andy MacAllister W5ACM
14714 Knights Way Drive
Houston TX 77083-5640

AO-40 Update

Following the successful launch of Phase 3D, now AMSAT-OSCAR-40, on November 16, 2000, most of us listened for telemetry or just settled back to wait for transponder experiments. No one knew that a wild ride was just ahead!

Early on Wednesday, December 13th, telemetry transmissions from AO-40 stopped while work on the main engine system was in progress. Within hours, E-mail activity on "AMSAT-bb" (go to [http://www.amsat.org] to subscribe) was incredible. What used to be a few hundred E-mails per week had now escalated to over 100 per day. If the telemetry had stopped at almost any other time, the event would probably have been given a nod, a simple reset command would have been sent to the satellite's IHU (Integrated Housekeeping Unit) computer, and system checkout, and other tests would have continued.

This was not the case. The loss of signal had occurred while valves in the propulsion system were being cycled. Due to the explosive nature of rocket fuel, and the pressures involved, this was not a good time to lose communications. Speculation, without sufficient data, swept through the AMSAT E-mail system.

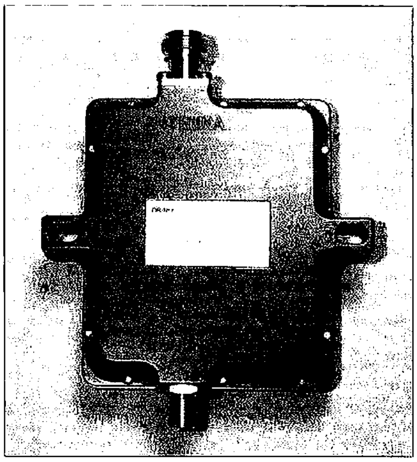


***Photo A.** The Drake 2880 commercial microwave downconverter.*

For both long-time and new satellite enthusiasts, it was a frightening and nervous moment. AO-40 is the largest and most valuable amateur radio satellite. It is not just a good thing and new toy for hamsat chasers; its long-term success or failure will have impact on amateur radio for years.

False reports about weak signals coming through on two meters or 70 cm were common. There was even an instance of someone sending signals through the AMSAT-OSCAR-10 transponder in an attempt to imitate AO-40 telemetry. Amazing.

In the meantime, the AO-40 ground control stations were carefully attempting to regain control. Karl Meinzer DJ4ZC coordinated these efforts, as the Phase 3D Project Manager Peter Guelzow DB2OS provided updates to AMSAT groups around the world as they became available.

Finally, on December 26th, Peter sent word that Ian Ashley ZL1AOX in New Zealand had successfully sent a reset command on the 1.2 GHz control frequency to enable the beacon transmitter on 2401.305 MHz. It worked. AO-40 was back on the air, but the big questions remained. What had happened, and how would it affect the mission?

The event

During the 12 days of silence in late December, many theories were voiced, publicly and privately, about what had happened and why. Like news commentators with little or no information about a calamitous event, many words were posted with little validity. Ideas ranged from an onboard explosion, a serious computer reset, or even a collision with a micro meteorite. The only theory not presented was an attack from a Martian warship.

Until all of the telemetry from before and after the 12-day silent period has been studied, only conjecture can explain "the event." It is known that there was a problem during the first attempted orbital-correction motor firing. When the burn occurred, it lasted a few minutes too long. A sticking helium tank valve was being cycled by ground controllers after the longer-than-expected first burn was completed. Did the cycling of the valve cause something to fail onboard? Hopefully, the answer will be available by the time you read this. Check out news updates from AMSAT [http://www.amsat.org] and AMSAT-DL [http://www.amsat-dl.org] for possible updates.

What's next?

When signals were once again streaming earthward from AO-40, and software uploads were working, it was time for a collective sigh of relief, but from a user standpoint several questions were evident.

It is apparent that the satellite's L-band (23 cm) receiver is working and that an S-band (13 cm) transmitter is operational. What if the VHF and UHF transmitters are out of commission?

The ground controllers will continue to analyze telemetry and test systems to find define any limitations caused by "the event." Early indications were that some temperature sensors were no longer working, and some current sensors were providing incorrect values. This would indicate something more than just a simple software glitch. If there are problems with some of the transmitters and receivers, we know that the 23 cm uplink and the 13 cm downlink work. It's a start.

Orbital corrections were not complete at the time of "the event." The current orbit is

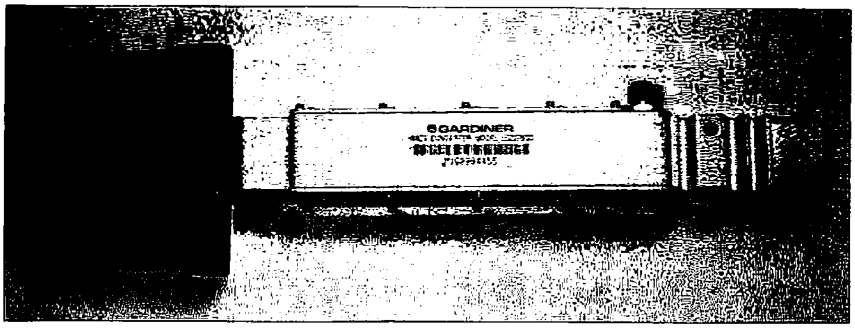


Photo B. An alternative downconverter by Gardiner.

not the desired high-orbit elliptical one that the designers want. Instead it has an extremely tall apogee, or high point, of nearly 64,000 km, and a low perigee, or closest point to the earth, of about 370 km. What if it is too dangerous to try to fire the main motor again?

Orbital studies have shown that the current orbit, although not optimum, is stable. Even with the frighteningly low perigee, predictions show that the orbit will outlive the satellite's batteries and electronics by decades. If no further main motor firings are attempted, some adjustments may be possible with the ammonia arc-jet motor, if it is still operational.

S-band reception

Until other onboard transmitters can be tested and brought on-line, it is necessary to listen for AO-40 on 2401.305 MHz SSB. The easiest way to do this is with a modified commercial TV downconverter originally designed for reception of AM TV between 2.1 and 2.5 GHz (MDS TV, Multipoint Distribution Service TV), and subsequent conversion to low or high VHF TV channels.

Photo C. Another alternative downconverter, from Pacific Monolithics.

The most common downconverter in use for S-band hamsat reception has been the Drake 2880. It was designed for an input range of 2.5 to 2.688 GHz, with output from 222 to 408 MHz. It is designed to be mounted at the antenna, operate from 13.7 to 24 VDC sent up the 75-ohm coax feed, and provide a noise factor of three dB. When it is used at nearly 100 MHz below its designed range, the internal gain and noise factor suffer. The output is also not within a ham band (two meters or 70 cm) when receiving 2401 MHz. Numerous experiments have been tested on the Drake to make it work better and provide more convenient operation for AO-40 reception. A good place to start if you are fortunate enough to have one of these units is on the Internet. Check out information from Jerry K5OE at [http://members.aol.com/k5oe/drake.htm]. Jerry provides first-hand experiences and a number of pertinent links to sites in England and Japan that provide everything necessary to get the Drake ready for use.

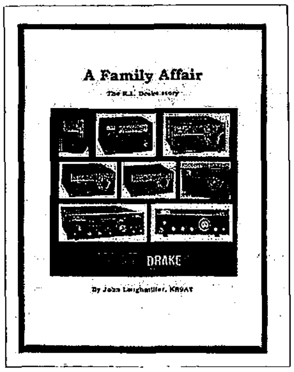
The Drake 2880 is not the only unit that can be used for AO-40 13 cm reception. Other successfully modified converters include Gardiner, Pacific Monolithics, Conifer, and others. Some good Internet sites to check for surplus converters and antennas include [http://www.antennasystems.com/broadband.html#anchor932487] and [http://www.phillips-tech.com/main.asp?page=page4.asp]. If all else fails, there are quality units built specifically for ham operation from SSB Electronics and Down East Microwave, to name two of the more common sources.

Telemetry

Until the satellite is opened for analog or digital ham-to-ham contacts, telemetry is the only thing heard from AO-40. The typical format is at 400 baud PSK (phase shift keying). This type of telemetry has been standard since the inception of the Phase 3 program over two decades ago. Hardware demodulators for this format are typically based on designs by James Miller G3RUH. However, with the proliferation of fast PCs, software alternatives have become common.

Using the line input on a typical PC sound card and appropriate software, the telemetry stream from AO-40 can be detected, demodulated, and displayed on a PC. With the addition of software for telemetry decoding, information on the satellite's status can be decoded and observed in real time. Go to the AMSAT Web site [http://www. amsat.org], find the link to "telemetry" on the opening page, and look for the P3T software from Stacey W4SM. You will also find links to sites that offer the sound-card demodulator and sources for code that work on non-PC systems. You'll enjoy the pursuit and the insight into AO-40's operations.

New Products



A FAMILY AFFAIR — THE R.L. DRAKE STORY

Here is the behind-the-scenes story of the famous R.L. Drake Company, focusing on the glory days when Drake was king of amateur radio. Every ham and shortwave listener knew R.L. Drake from the outside, but now the inside story of this incredibly interesting company is told. This book also includes a huge section of useful circuits and modifications for many Drake radios. At 300 pages, it's an interesting read and a great technical reference. #1487, 8-1/2 x 11 inches, $29.95.

For further information or to order, contact Universal Radio, Inc., 6830 Americana Pkwy., Reynoldsburg OH 43068; tel. (800)-431-3939; [www.universal-radio.com].

ICOM'S IC-910H SATELLITE RADIO

The IC-910H VHF/UHF all-mode transceiver offers a full 100 W on VHF, eliminating the need for an external high power amplifier for satellite uplinks. For mode-J satellites, there's 75 W of output on UHF.

With dual high sensitivity DSP-compatible receivers, weak signal DX and satellite communications are second to none. Optional preamps for each band are available for installations requiring additional receive gain.

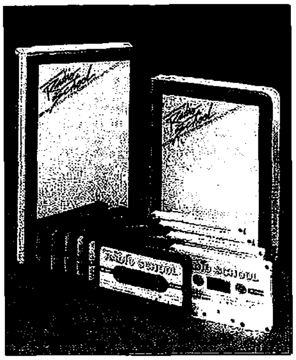
For further information, contact Icom America, Inc., 2380 116th Avenue N.E., Bellevue WA 98004, or your nearest Icom dealer.

ANTENNAS: FROM THE GROUND UP

"Volume I, Numbers 1 to 20" of this work by L.B. Cebik W4RNL is a practical-level antenna book for technicians, amateur radio operators, and students, providing direct and clear information on the theory of antennas "from the ground up." The reader gets a set of rational expectations based on as much clarity as a nonmathematical treatment of antennas can provide.

The book is based upon the kinds of questions the author receives from folks struggling to set up or improve an antenna within the limitations of modern yard sizes and budgets. Scattered among the chapters are a compendium of typical antenna patterns for common antennas on all of the HF bands. Setting reasonable expectations for antenna performance is the main goal of this book. #MFJ-3306.

For further information, please contact MFJ Enterprises, Inc., PO Box 494, Mississippi State MS 39762; tel. (800) 647-1800; fax (662) 323-6551; E-mail [mfj@mfjenterprises.com]; site [www.mfjenterprises.com].



FREE ON-AIR CODE LEARNING INSTRUCTOR CASSETTES

Morse Code instructors may hold their code-learning classes over their local repeater or simplex frequencies with free code-learning cassettes from Gordon West WB6NOA. Each cassette is 90 minutes long and recorded monaurally for easy player-to-microphone pickup.

"All of the code-learning practice is narrated, and these audio cassettes are ideal for instructors to play over their local repeater system," comments West, well-known for his innovative amateur radio teaching methods and materials.

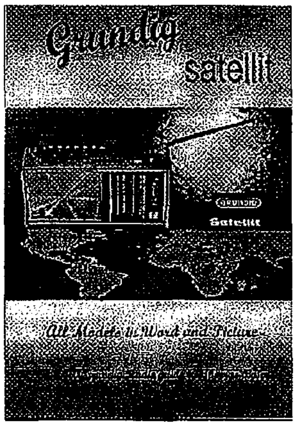
"Instructors may also use these cassettes in the classroom, too, working in live code off the air as well as for additional code practice using computer programs or a set of paddles," adds West.

CW instructors may receive these cassettes at no charge by including a brief letter describing their upcoming on-air or in-class scheduled code course, as well as 10 first-class stamps for Priority Mail delivery.

"These free training cassettes are part of the Ham Ambassador program, and I encourage all instructors and repeater control operators to take advantage of this unique teaching opportunity," concluded West.

Send your request and class details to: Gordon West Radio School, 2414 College Drive, Costa Mesa CA 92626.

GRUNDIG SATELLIT — ALL MODELS IN WORD AND PICTURE



In this book you'll find all the details for each model of the famous Grundig Satellit series. Tons of photos, fact, and specs for every member of this line, from 1964 to 2000. Over 120 photos show interiors, accessories, manuals, and even boxes. #2416, 126 pages, 5-3/4 x 8 inches, $19.95.

For further information or to order, contact Universal Radio, 6830 Americana Pkwy., Reynoldsburg OH 43068; tel. (800) 431-3939; [www.universalradio. com].

Jack Heller KB7NO
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DigiPanning

Lots of updates are here for the taking. These computer-crafted radio modes seem to sprout new modes and updates for earlier programs like weeds in the spring lawn. I was going to say older programs instead of earlier. And that could have been politically correct in computer terms, but most of the soundcard software has been around less than two years.

By the time I get this off to the magazine and you have it in your shack, even all I tell you about the new stuff will often have been replaced. It is fascinating how this is working. There is a virtual explosion of technology and we in the ham community are reaping the benefits.

This month's column will feature the latest, at this writing, of DigiPan, version 1.5. I had almost forgotten about what a great program this is. I had used it and downloaded a few of the updates through version 1.2 and was impressed with the intuitiveness of the program. It is still just as easy to install, set up and use as the earlier versions. What happened to the two "missing" versions seemed to have been a programming misfire, but the 1.5 really works.

It has two receive panes and they are large enough to hold 8 or 9 lines of text each, thus giving you time to read what is going on and see who is talking without fiddling with the scroll bars. Some of the programs with more than one receive pane get very limited in the amount of text they can hold. I shouldn't complain, though, because you can drag the divider between panes, even in DigiPan, and make one large receive pane if you wish.

My definitions of easy

After I recalled it was time to check on the new version, I went to *The Chart*, copied and pasted the URL to my browser, and let the system put the file where I could find it. Then I recalled that the last version I had downloaded was a misfire, so I brought up the "Install/remove program" option in Windows95™ and removed the existing copy.

The second step was to double-click on the recently downloaded file, follow the few instructions necessary, and the new software was installed. No fancy footwork or files to create by hand, just simply install it. I found the macros were in place from the prior installation, so there, again, was no extra effort needed.

The next step, after nosing around to see what was new, was to power up the rig and see what was going on. A few mouse clicks later and readable print was traveling across the monitor.

The fourth step in this success story was to answer a CQ from a UA0 just north of Japan. The path wasn't too great, but we copied each other well enough to call it a QSO. Just that easy — 1, 2, 3, 4, and we work a little DX on PSK31!

It was now time to go back and figure out a few things that didn't seem quite so obvious (unintuitive?). I still didn't have the foggiest idea how to actuate the second receive panel. I was only using half the available listening capabilities. Well, that was simple also.

When it is necessary to ask for help, DigiPan gives it big-time. It looks as though the help file spells out everything you will ever need to know about how to run the software. The file is extremely well written and I found several answers about as quickly as if the author were standing over my shoulder.

There is a pull-down menu that allows you to choose the two-channel capability, and I had found that but I needed a little more. The explanation was simple. You change the first or upper receive pane frequency by clicking the left mouse key in the waterfall on the desired signal. The lower pane is controlled with the right mouse key in the same manner. I probably would not have stumbled on that by myself, but it certainly was simple to find in the help file. (See **Fig. 1.**)

The second question I had was one I had learned about in a previous version and promptly forgot, and that was how to calibrate the spectrum line above the waterfall. I believe a search for "calibrate" turned up the answer to that one immediately, and a few more clicks and the line was reading as if it were meant for this place.

The program is just simply easy to use. I think that is why there are so many users. There is a minilog you can use and then export for your regular logging program. As a matter of fact, if you do not have a separate logging program and wish to do so, the minilog may answer all your needs, at least as far as working this mode goes.

One of the important features of using ham-generated software for this kind of mode is to have macros ready to do the typing (and save the thinking) for you. DigiPan has the capability of defining 24 macro buttons to do whatever you wish. Some are already defined for you, some are not defined. You will find they are easy to edit in the pop-up window when you right-click on any of the buttons. Instructions are contained within the window.

A few of the important macros are ready to use right-out-of-the-box. CQ is there, along with a button to answer a CQ, as well as buttons for turnovers and ending a QSO. I will edit these to suit, and, as I said, the editing is a cinch with the examples and needed reminders at hand as soon as you right-click on the button. Twelve macro buttons are shown across the top of the screen; then they are redefined as a second set of twelve when using the Control key.

If you haven't as yet gotten into soundcard modes, the DigiPan Help File has a section on that under "Equipment Setup." You can find how to route cables or make

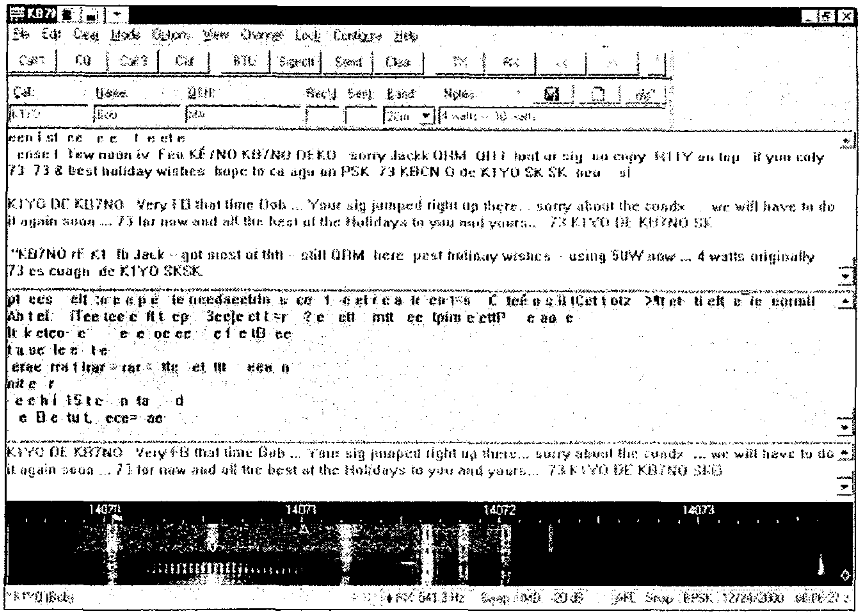


Fig 1. Screenshot — DigiPan 1.5. This is new-and-improved software that so many hams have so willingly taken into their lives. This wasn't the best demo, but I wanted to show that a QRP station (at the other end) was making it. In the end, he was doing better than I with my big-gun 50 watts. His 4 watts started out real well. So I was concentrating so closely on this that the copy on the second pane which had been from the 14.071 marker got away. The little triangle at that frequency indicates where the lower (2nd) pane would be printing copy from. The upper pane frequency indicator has a little flag attached and is just to the right of 14.070. Left button snaps the pointer with the flag to the point in the waterfall where you spot a signal. Right mouse button does the same for the triangle indicator. The Help file is a wonder for clarity and information. Just about any reasonable question is answered so you can understand what you need to do. The macros, 24 of them, are easily edited and this is explained well. There is also sufficient information for transferring your mini-log info to your regular logging program if you desire. You will find just about everything you need short of a transceiver and an antenna to get you going in PSK31. Go for it!

up a PTT circuit (just like the one I use). It is thorough but not overkill. There is everything you need to get you going in PSK31.

Plus, if you don't wish to be bothered with the home-brew method of cabling and tweaking, the DigiPan Web site shows a reasonably priced interface that could save you a lot of steps. I haven't spoken with anyone using this setup as of this writing, but it is a good premise, an easy way to skip some tedium.

As many of you know, the author of this program, Nick, also writes MixW, a much more intense effort. MixW, in addition to doing a good job on PSK31, gets you into RTTY, packet, CW, and a few experimental modes, plus you can copy Pactor and Hellschreiber. There is a version 2 of MixW being awaited by those of us who see the fruits of Nick's efforts. I hope it works as well as this latest DigiPan. You can get a free demo of MixW by following the URL listed in **Table 1**.

WinWarbler fans will be pleased to know Dave is still tweaking that program. I received an E-mail notice the other day that he had added a bit of clarity to the waterfall. I had heard a few complaints on the subject, so I downloaded the latest update, and it looks very good. The latest update when I started this paragraph was version 1.89. I just checked again and it is version 1.90. Where the technology goes by the time you read this, I cannot predict. It all moves very fast.

Better news yet, the Web site where you would normally download the WinWarbler software along with other of Dave's many creations contains instructions about getting and installing the updates. I did not realize this and was several updates behind. Of course, not knowing any better, it was working just fine. (Ignorance is bliss.)

I also received a message that the Zakanaka first version was ready for download. That is a fascinating project, but I ran into complications that thwarted the actual viewing. Some strange little glitch prevented me from getting a complete download of the file.

"So," thought I, "I will fix this." A friend had informed me he had overcome some download problems by replacing his copy of Netscape 4.7, the one I am using, with the new version 6. Then, for some reason on that day, I even had a problem downloading from Netscape.

The next day, the download from Netscape came off like a champ. The "path" must have improved, things are bound to look up. It was entertaining, to say the least, watching the new version of Netscape install itself as it was downloading. Quite a marvel in programming, I was thinking.

Then began the agony of watching this old 120 MHz computer crawl through the paces trying to sort out all the baggage in

the new Netscape package. That is the nicest way to relate my thoughts. But I persisted and attempted the Zakanaka download with the new "hot setup." Worked better, but not good enough. Never made it. A little window came up and said the download was complete when I knew it was about 25% short.

Oh well, what is left is to uninstall this fat new Netscape and watch for new opportunities to see the fabled Zakanaka in action. The lesson in all this is that there are many programs being written that will only run on very high end, one gigahertz machines. I am getting a little dismayed. I don't see any reasoning for this trend. But I am not in the business of marketing the Internet, any of the browsers or the latest computers.

I merely try to find ways for you to have fun with your computers which, in some cases, are not as speedy as the one I am sitting in front of at this moment. I figure if the lash-ups I find will run on this, they will probably perform well on your computers in your shacks.

Just as a little aside, but on the same subject, a while back someone suggested one of the freebie virus scan programs. I downloaded it, installed it and that one apparently checked the system continuously. The reason I drew that conclusion was the computer was in a perpetual state of slowness. I guess it too, would be a good program for the newest, fastest processor. Another uninstall.

What I am saying is there is still a lot of life left in these machines that are a few years into obsolescence. You do have to use the correct software. You can have a ball with PSK31, RTTY, MFSK16, SSTV, and most any new mode that is going to pop up with out shelling out for a new computer or other expensive hardware.

That is one of the factors that has always brought people to this hobby. I hear of loud-signal SSB and CW contest stations costing as much as a fancy house. And that is okay by me, everyone should have the choice to exercise that option. We can all coexist at whatever level we prefer.

Lately, I have worked several stations who were using 2 to 5 watts output on PSK31. One of them, I understood, was using one of the little QRP transceivers that costs less than $200. Couple that with a low-buck laptop and, if the laptop is a bit ancient, use the G3PLX software for PSK31. You can get versions to run in DOS or Windows 3.1. Talk about using old tech.

A little power from a cigarette lighter socket alongside the road and you can have a small and very portable digital station that will work the same size world as the big-gun DX stations I was just mentioning. You may just not do it quite as quickly. It is a little like licking the ice cream cone rather than wolfing it down. The pleasure lasts longer and sometimes the taste is sweeter.

Another program I have let slip through the cracks is Throb. This is a creation of Lionel Sear G3PPT and is showing a lot of promise. It is reported, as was intended, to have superior throughput when the going gets rough.

I had downloaded an earlier version a few months ago and did not have much luck getting it comfortable in this system. At the time, there were too many unanswered questions.

Due to a bit of prodding, I downloaded the version 2.5, installed it, and carefully read the instructions. I wanted a success story to report. It worked. The only thing that did not cooperate was the PTT. And that, I am sure, can be easily explained. That I can work around.

I was finally able to hear the transmitted signal and even sent a series of CQs the other evening. I didn't really expect a reply, but it was fun to just see that here was this new mode working as expected. I had hams telling me for about a month that their copy worked. I am glad I went back and gave it another try.

Continued on page 59

Source for:	Web address (URL):
Mix W Soundcard program for PSK31, RTTY, new modes, MTTY, FSK31, more	http://tav.kiev.ua/~nick/my_ham_soft.htm http://users.nais.com/~jaffejlm/mixwpage.htm
MMTTY New RTTY soundcard freeware plus links to other software	http://www.geocities.com/mmtty_rtty/
TrueTTY — Sound card RTTY w/ PSK31	www.dxsoft.com/mitrtty.htm
Pasokon SSTV programs & hardware	www.ultranet.com/~sstv/lite.html
PSK31 — Free — and much PSK info	http://aintel.bi.ehu.es/psk31.html
Interface for digital - rigs to computers	www.westmountainradio.com/RIGblaster.htm
Interface info for DIY digital hams	www.qsl.net/wm2u/interface.html
WinWarbler info and free download	www.qsl.net/winwarbler/
MFSK — related tech info — how it works	www.qsl.net/zf1bpu/
Throb — New — lots of info	www.lsear.freeserve.co.uk/ www.btinternet.com/~g3vfp/
Site with links to PSK31 and Logger 7, also Zakanaka	www.geocities.com/kc4elo/
PSKGNR — Front end for PSK31	www.al-williams.com/wd5gnr/pskgnr.htm
Digipan — PSK31 — easy to use — new version 1.5	http://members.home.com/hteller/digipan/
TAPR — Lots of info	www.tapr.org
TNC to radio wiring help	http://freeweb.pdq.net/medcalf/ztx/
ChromaPIX and ChromaSound DSP software	www.siliconpixels.com
Timewave DSP & AEA (prev.) products	www.timewave.com
Auto tuner and other kits	www.ldgelectronics.com
XPWare — TNC software with sample DL	www.goodnet.com/~gjohnson/
RCKRtty Windows program with free DL	http://www.rckrtty.de/
HF serial modem plans & RTTY & Pactor	http://home.att.net/~k7szl/
SV2AGW free Win95 programs	www.raag.org/index1.htm
Source for BayPac BP-2M & APRS	www.tigertronics.com/
BayCom — German site	www.baycom.de/
BayCom 1.5 and Manual.zip in English	www.cs.wvu.edu/~acm/gopher/Software/baycom/
Int'l Visual Communication Assn. — nonprofit org. dedicated to SSTV	www.mindspring.com/~sstv/
Creative Services Software	www.cssincorp.com
Hellschreiber & MT63 & Stream & scope	www.freeweb.org/varie/ninopo/iz8bly/index.htm

Table 1. The Infamous Chart — Almost everything ... updated monthly.

By Eric Shalkhausser W9CI, SK

The History of Ham Radio

Part 4: The early 1920s.

The early days of radio embraced an era filled with gusto ventures and exciting stories, true tales from yesteryear we proudly relate to you through this "History of Ham Radio" series. It is our sincere wish that you remember these stories and pass them on to future generations later in time — with a similar "pass it on down" stipulation. Through our joint efforts, amateur radio's legacy will live forever. This month, in Part IV, we go back to the days of spark gaps and ozone in the shack.

During 1921, for sending their signals, amateurs were still thinking in terms of spark transmitters. The vacuum tube, as a simple three-element detector, was being advertised prominently and illustrated profusely in all the wireless literature. Not until the VT-1, 201, 202, and other tubes came along could much conversion from spark transmitters take place. It was well into the 1921–1922 period that this happened, with the realization that wavelengths below 200 meters were of considerably more advantage for DX and better tuning characteristics than those at 200 meters and above.

While in the Signal Corps Officers' Training Camp in College Park MD in 1918, I saw and operated the first three-tube transmitter. It was similar in appearance to the first three-tube DeForest set that was extensively advertised in radio periodicals in 1921. It came equipped with Western Electric VT-1 tubes.

Reprinted from *73 Amateur Radio*, July 1977, where this was originally reprinted from *QCC News*, a publication of the Chicago Area Chapter of the QCWA.

Construction articles appeared monthly in the 1920 and 1921 magazines. These were simple circuit diagrams showing applications. The Fessenden, the Marconi, the Telefunken, the Colpitts and many others were displayed. The radio amateur was doing a lot of experimenting in adapting this new device to all sorts of circuit layouts with the goal of improving the reception and transmission of signals.

Amateurs and commercial interests devised all sorts of receiving circuit combinations under such names as the *neutrodyne*, the *amplidyne*, the *Roberts*, the *Cockaday*, etc. One must remember that radio broadcasting had its real beginning in earnest right after

Photo A. Peoria Radio Sales Co., 1923–1924.

World War I, and the general public became all agog over this new mysterious phenomenon entering their homes. Hearing strange voices and music out of nowhere ... through earphones ... without wires ... It was unbelievable!

From now on, the ham was no longer alone with his dots and dashes in his little cubicle, carrying on his own brand of mysterious private conversation.

Serious consideration was being given by the amateurs to the possibility of making improvements in signal reception by adding several stages of tube amplification to the detector. The single crystal detector and the old coherer could now be permanently replaced and abandoned. Those weak and often inaudible signals could now be picked out with ease and at a greater distance. And so, with the discovery of the regenerative circuit by Major Armstrong, the vacuum tube *started to oscillate* and gave signals a thousand-fold boost in strength.

The vacuum tubes were not quite ready for transmission purposes. Their lack of ruggedness, their size, their cost, and their scarcity held back adaptation by the amateur fraternity of tubes for strong CW signal generators. After the war, and even into 1922, amateurs who had served Uncle Sam were still operating their spark transmitters.

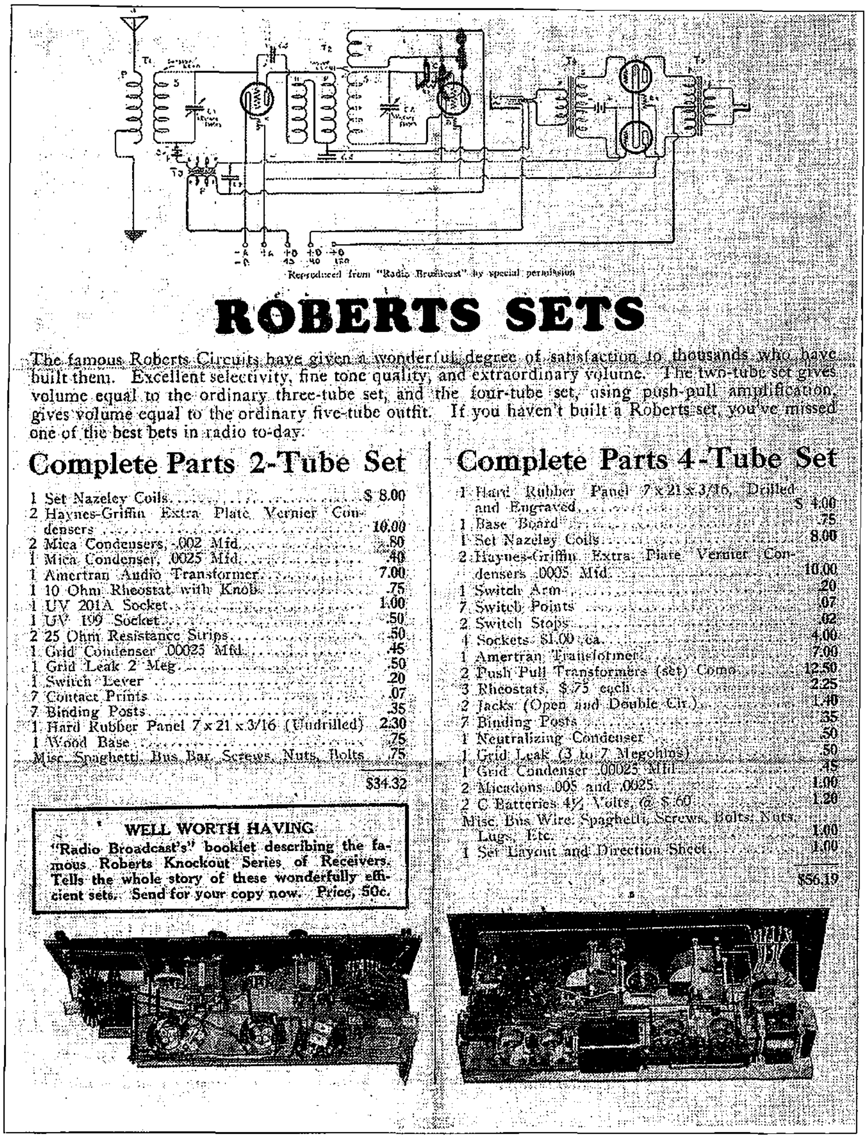
Photo B. Radio pictorial.

Many of us were familiar with either the Army Signal Corps or the Navy gear. They all looked and operated alike. In the beginning of wireless adaptation to the armed services, very little innovation could be expected for field combat purposes. The quenched gap transmitter stood out as a most reliable unit. To the ham this was proven equipment. True, it operated in many instances from a 500 cycle source of power, but it was regarded as a dependable unit to cover fairly long distances and was used by commercial companies in the field. It was semiportable when loaded on a horse, a mule, or a two-wheeled cart.

The returning amateur was trained in the use of such transmitting equipment and took a fancy to the unit. He was very familiar with its performance, knew how to operate it, and had practical knowledge of its capabilities and application. During his period of service he was always thinking in terms of adapting it to his own use if and when he got back home. The one and only drawback was the 500 cycle power input. Replacing the quenched gap in the circuit proved a minor drawback.

When we examine the spark gap circuit used in all stations as illustrated and described in the literature of the early 1920s, it can be said that it was really quite simple and direct, and not difficult to understand in operation and performance.

The "spark-gap ham" preferred to build his own condenser. He would use glass plates, mostly 8" x 10" in size, obtained from a photographer who was ready to discard them. (Exposures were made on glass plates "in them olden days.") These were covered, both sides, with tin or aluminum foil or other thin metal sheets. Tobacco pouches were often sources of foil. Enough plates were coated so that the assembled condenser gave a value of .01–.012 µF. To make sure that the unit could withstand potential surges as high as 25,000 volts, four of these sections were connected in series-parallel,



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ROBERTS SETS

The famous Roberts Circuits have given a wonderful degree of satisfaction to thousands who have built them. Excellent selectivity, fine tone quality, and extraordinary volume. The two-tube set gives volume equal to the ordinary three-tube set, and the four-tube set, using push-pull amplification, gives volume equal to the ordinary five-tube outfit. If you haven't built a Roberts set, you've missed one of the best bets in radio to-day.

Complete Parts 2-Tube Set

1 Set Nazeley Coils	$ 8.00
2 Haynes-Griffin Extra Plate Vernier Condensers	10.00
2 Mica Condensers, .002 Mfd.	.80
1 Mica Condenser, .0025 Mfd.	.40
1 Amertran Audio Transformer	7.00
1 10 Ohm Rheostat with Knob	.75
1 UV 201A Socket	1.00
1 UV 199 Socket	.50
2 25 Ohm Resistance Strips	.50
1 Grid Condenser .00025 Mfd.	.45
1 Grid Leak 2 Meg.	.50
1 Switch Lever	.20
7 Contact Prints	.07
7 Binding Posts	.35
1 Hard Rubber Panel 7 x 21 x 3/16 (Undrilled)	2.30
1 Wood Base	.75
Misc. Spaghetti, Bus Bar, Screws, Nuts, Bolts	.75
	$34.32

WELL WORTH HAVING

"Radio Broadcast's" booklet describing the famous Roberts Knockout Series of Receivers. Tells the whole story of these wonderfully efficient sets. Send for your copy now. Price, 50c.

Complete Parts 4-Tube Set

1 Hard Rubber Panel 7 x 21 x 3/16, Drilled and Engraved	$ 4.00
1 Base Board	.75
1 Set Nazeley Coils	8.00
2 Haynes-Griffin Extra Plate Vernier Condensers .0005 Mfd.	10.00
1 Switch Arm	.20
7 Switch Points	.07
2 Switch Stops	.02
4 Sockets $1.00 ea.	4.00
1 Amertran Transformer	7.00
2 Push Pull Transformers (set) Como	12.50
3 Rheostats, $.75 each	2.25
2 Jacks (Open and Double Cir.)	1.40
7 Binding Posts	.35
1 Neutralizing Condenser	.50
1 Grid Leak (3 to 7 Megohms)	.50
1 Grid Condenser .00025 Mfd.	.45
2 Micadons .005 and .0025	1.00
2 C Batteries 4½ Volts, @ $.60	1.20
Misc. Bus Wire, Spaghetti, Screws, Bolts, Nuts, Lugs, Etc.	1.00
1 Set Layout and Direction Sheet	1.00
	$56.19

Photo C. Roberts sets.

making the capacitance still the correct value, approximately 0.01 µF. The whole thing was immersed in oil. Not to do so caused corona discharges around the edges. Being well-soaked made them stand up much better under the high potentials. Even then, they punctured unexpectedly!

The high potential was quite dangerous around the place. It was important that the condenser box be surrounded by a protective wall and openly marked: DANGER — HIGH VOLTAGE — KEEP YOUR DISTANCE!

The discharge gap in the circuit is in series with the primary spiral inductance, usually made of flat-wound brass or copper ribbon. This was known as the oscillation transformer. Every time the key in the low voltage primary circuit was closed, the charged condenser let loose for the shortest fraction of a second, in rapid fire, and discharged across the spark gap. On discharge, the energy surged around the helical coil, and, in turn, the secondary coil inductively coupled to the primary received a burst of electromagnetic energy. This in turn sent a damped wave signal out into the ether by way of the antenna configuration. A hot wire ammeter in series with the antenna to ground connection indicated the amount of current being emitted. A fuse block in the main power line provided protection against overloads.

Although the circuit looked quite simple, we amateurs had other problems to contend with in meeting the 200 meter (or less) wavelength requirements. The condenser design value had to stay within the above stated µF limits. I will not attempt to delve into the mathematical equations to prove the point. Remember that we had a wrong concept of wavelength versus distance in those days.

Some amateurs were in a position to obtain 500 cycle power generators. Many signals could be heard on the air using such units. The signal coming from a 500 cycle source had a distinct tone quality. It was music to many an ear.

By way of interest, here is a statement which appeared in *Radio Amateur News* in 1920:

"Surely the US government is not imposing upon the American amateur when he limits the operating wavelength of your transmitter to 200 meters. Contrast this law to that of Canada, where the limit is placed at *50 meters.* As a Canadian amateur recently remarked, with this short wave we may consider ourselves fortunate indeed to cover the extraordinary distance of one mile. As for democratic England, the would-be amateur is simply out of luck, for no license or permission is at present even obtainable under any condition. From the foregoing, we may therefore deduce the timely moral: *Keep your transmitter on the lawful side of 200 meters.*"

The amateurs up to now had really not discovered the potentially great advantage of the shorter wavelengths.

The rotary gap caused havoc on many occasions, since the studs had a tendency to become pitted after a short time of operation unless constructed of stuff that withstood the constant arcing in an open oxygen atmosphere. Of considerable help was an enclosed gap, sufficiently airtight to exclude oxygen to the extent possible.

Much experimenting with the number of studs on the rotor and the speed of the motor improved the efficiency of the system. An 1800 rpm synchronous motor and a wheel with twelve well-designed studs, made of material that could withstand pitting, usually

Continued on page 61

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Read All About It!

Part 5 of good stuff from The Hertzian Herald.

This time: Lessons from industry; Yours truly, RMS; and Who said that?

When I was a very young engineer I took a job with an elevator company and was assigned to design several pieces of test equipment for an electronic elevator controller. I was given a four-month timetable. The senior engineer to whom I reported, Gary, was the guy who had designed the controller, and he was a whiz. It soon became apparent that he knew way more than I did about electronic systems — so much so that I began to feel a little inferior. I would spend half an hour every morning picking Gary's brain about how his system worked, and then work the rest of the day trying to devise circuits to run his system through its paces to verify that it was doing what he designed it to do.

About midway through the project, Don, the vice president of engineering, invited me to have lunch with him. I was young, as I said, and foolish, and I brashly asked, "Don, why did you hire me? This test gear that I'm taking four months to design — Gary could do that in two weeks."

Don smiled and said, "I know that — but Gary is my system designer and he's working on our next new product. I can't spare him for two weeks. If I could find another genius like Gary, I'd hire him — but I can't, so I have to hire guys like you. Gary can't do it all alone."

Since then, I've met some very impressive engineers who have worked on the space shots, the stealth bomber, and the latest microchips. I'd envy them for a while, but then I'd remember: "Gary can't do it all alone — they need me, too."

Once, at another company, my boss, Joe, came up just before quitting time and asked me to work up a calculation for the minimum beta required for the transistor in the "keyer" circuit of a display panel we were building. It seems that our shipment of transistors had gotten lost, and we would have to shut down production the next day unless some more could be found.

Well, the transistors had a guaranteed beta of 80, and we had been testing them all, so we had a bin full of rejects that fell below 80. If I could verify by calculation that the value actually required in our system was, say, 50 or above, Joe could have the rejects retested and pick out those that were 60 or above and keep the production line going.

Next morning, while trying to wake up with my first cup of coffee, I started scribbling the calculations on a yellow pad. It came quite easily, and I had just gotten the number (46) when I heard Joe come up behind me. "Got that beta minimum?" he asked.

"Just got it," I said. "Let me recopy this in good form and we can have it out on an ECO (Engineering Change Order) in half an hour."

"No time for that," he said. "I'll just photocopy this and attach it to the ECO form." And with that he grabbed

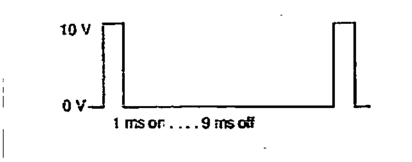

Fig. 1 An example using a 10 V DC pulse with a 10% duty cycle, applied to a 1-ohm resistor.

Reprinted with permission from *The Hertzian Herald*, newsletter of the Monroe County (MI) Radio Communications Association (MCRCA).

my coffee-stained scribble sheet and had it sent all over the plant with my name on it.

Since then, I don't make so much as a grocery list unless I do it neatly and in engineering form. And neither do I let my students get by with saying, "This is just my scribble sheet; I'll recopy it neatly later."

Yours truly, RMS

This time, let's discuss the mysterious letters "RMS." RMS is a way of measuring AC voltages and currents so that when you do Ohm's Law ($P = V^2/R$ or $P = I^2R$) on a resistive circuit, you get the same results as with DC. Briefly, RMS means "equivalent to DC." The letters R-M-S stand for a mathematical technique in which you take the Root of the Mean of the Square. **Fig. 1** shows an example using a 10 V DC pulse with a 10% duty cycle, applied to a 1-ohm resistor.

Square: During the 1 ms on time, power is $V^2/R = 10^2/1 = 100$ W. During the off time, power is zero.

Mean: Average (mean) power is on-time power times the duty cycle: $P_{avg} = 100 \text{ W} \times 10\% = 10 \text{ W}$.

Root: The DC voltage that produces 10 W in a 1 ohm resistor is $V = \sqrt{PR} = \sqrt{10 \times 1} = 3.16$ V. The pulse wave has an RMS value of 3.16 V. Note that RMS is not the same as average. The average voltage of the pulse wave, above, is 10 V x 10%, or 1.0 V.

To do the RMS technique on a sine wave, you have to slice the wave up into hundreds of time slots, square the voltage during each time slot to get hundreds of instantaneous powers, average all the powers over a full cycle, and take the square root to find the DC equivalent voltage. A computer can perform the hundreds of calculations necessary easily. The mathematics of calculus can actually slice the wave into an infinite number of time slots, square them all, average them, and get the square root — all in one operation.

The result, for a sine wave, is that a 1.414 V peak sine wave has an RMS value of 1.000 V. (Interestingly, 1.414 is the square root of 2.) Thus, for a sine wave, $Vr_{ms} = V_{pk}/1.4114$ and $V_{pk} = 1.414\ V_{rms}$.

RMS is the standard way of measuring AC, so the "120 V AC line" actually has a peak voltage of 1.414 x 120 = 170 V.

The average value of a sine wave is, of course, zero; the negative half cycles cancel the positives. But the absolute average value (without regard to sign) of a 1.00 V RMS sine wave is 0.90 V. Ordinary AC meters (VOMs and inexpensive DVMs) respond to the absolute average value of the AC wave, and indicate 1.00/0.90 or 1.11 times that value. For a sine wave, this turns out to be the RMS value. For AC waves that are not sine-shaped, the reading is quite meaningless. For our 10 V, 10% pulse wave, the RMS value is 3.16 V and the average value is 1.00 V, but the reading would be 1.11 V.

TRMS meters are available (for a price) that will give the True RMS value of a non-sine wave, but read the specs closely. If the TRMS meter has a low-frequency cutoff, it will screen off any DC before taking the measurement. On such a meter, our pulse wave would read 3.00 V, not the correct value of 3.16 V.

Some final notes: (1) When you use RMS voltage or current to calculate the power in a resistor, you get average power. There is no such thing as RMS power. (2) You can use peak voltage to calculate instantaneous peak power, if that's really what you want — but this is not standard, and not "equivalent to DC." Unscrupulous stereo-amp manufacturers used to advertise "peak power" until the FTC shut them down. A few even calculated something they called "peak-to-peak power" — a total fraud — and advertised that to hapless customers.

Who said that? (Answers at end)

1. "Our inventions are but improved means to an unimproved end. We are

in great haste to construct a magnetic telegraph from Maine to Texas; but Maine and Texas, it may be, have nothing important to communicate. We are eager to tunnel under the Atlantic and bring the old world some weeks closer to the new; but perchance the first news that will leak through to … America will be that the Princess Adelaide has the whooping cough."

2. "My dear, you fail to read the scale/ Correct to tenths of a division./ For gentler trade, those eyes were made/ And not for methods of precision."

3. "I, too, am an amateur."

4. "It ain't the things you don't know that get you into trouble. It's the things you know for sure — that ain't so."

Answers:

1. Henry David Thoreau wrote that in his essay "Walden" in about 1850. The first intercity telegraph line, from Washington DC to Baltimore, had been completed in 1844. The first successful "tunnel under the Atlantic" began operation in 1866. I often sigh and think of Thoreau's remark when a ham sends QRU TNX ES 73 on the second transmission. Nothing important to communicate.

2. James Clerk Maxwell, in England, penned those whimsical lines about female students in his physics classes — then called natural philosophy classes. By about 1864, Maxwell had devolved a set of 20 equations (later compacted to four) from which all of electrical and radio science can be derived. Yes, Ohm's Law, the capacitive-reactance formula, all the transmission-line and antenna formulas —all of them are implicit in the four equations of Maxwell. Among other things, Maxwell's equations predicted the existence of radio waves. Heinrich Hertz, in Germany, managed to generate these waves (wavelength about 6 meters) and send them across a room in 1888. Marconi, in Italy, read of Hertz's work, and the rest is well known to history. Aside from a stereotypically Victorian attitude on the "place" of women, Maxwell's lines show that a towering mathematical genius can have a touchingly human side.

3. Guglielmo Marconi said those disarming words to ARRL representative Paul Godley in 1921, when the latter had come to Great Britain to attempt the first reception of amateur signals across the Atlantic. (He was successful.) I take nothing away from the real achievements of Marconi — they were many and impressive. But the public acclaim that was lavished on him was not accorded to others of equal accomplishment, because they were not "smooth operators." For example, Marconi's claim to have achieved trans-Atlantic communication in 1901 was universally accepted, even though he and his assistant were the only ones to hear the signals. And in 1912, he personally blocked news from the *Titanic*'s rescue ship because he had made a lucrative deal with the *New York Times* for an exclusive story. But the public still lionized him.

4. While not original with him, this was the favorite quote of Major Edwin Howard Armstrong, inventor of regeneration (1912), the superheterodyne (1918), and FM radio (about 1935). The triode vacuum tube (1906) was "known" to be a little less sensitive and a lot more troublesome than the crystal detector until Armstrong showed what it could do in a feedback circuit. Heterodyning was known as a curiosity; "The Major" gave us the standard radio receiver circuit by heterodyning to a super-audible frequency. FM had been "proven" by mathematics to have "no advantages whatever," but Armstrong refused to believe it until he had tried it for himself. Commenting on his inventive style, Armstrong said, "Inventions are not made by theoretical musings, but by jackassing storage batteries around the laboratory." Perhaps the day for that kind of stubbornness is over, but a part of me hopes that it is not. 73

Build Yourself an NVIS

continued from page 18

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QRP Drives Ham Nuts

continued from page 30

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Calendar Events

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its 23rd annual Hamfest/Computerfest on March 25th, 8 a.m.–2 p.m., at Madison High School on North Ridge Rd. New and used amateur radio, computer, and other types of electronic equipment will be featured. VE exams will be held for those interested in earning an amateur radio license. Admission $5. 6 ft. tables $8 each, 8 ft tables $10 each. Call Roxanne at *(440) 257-0024* to make table reservations.

MONROEVILLE, PA The Two Rivers ARC, Inc. of Greenock PA will hold their 29th annual Hamfest Computer Fair 8:30 a.m.–3 p.m. at the Palace Inn in Monroeville PA, (intersection of Routes 22 and 48, at turnpike). Vendor setup 6 a.m.–8:30 a.m. The registration deadline is March 9th. A confirmation will be sent upon receipt of payment. 6 ft tables including 1 chair, $20 each, includes one vendor admission per table. 115/60 outlets are $10 each. Additional vendor passes are $5 each. Vendors using electrical outlets are responsible for providing multiple breakout strips or extension cords if needed. Food may NOT be sold by vendors.

Make checks payable to Two Rivers Amateur Radio Club, Inc. and mail to *Two Rivers Amateur Radio Club, Inc., Roxane Gaal, Hamfest Coordinator, 312 Lawrence Ave., N. Versailles PA 15137. Tel. (412) 823-6613; or E-mail [gaal@pgh.net].*

MARCH 31

WATERFORD, CT The Radio Amateur Society of Norwich CT will hold their 31st Ham Radio Auction at the Waterford Senior Center on Rt. 85, starting at 10 a.m. Setup at 9 a.m. From Hartford, take Rt. 2 South to Rt. 11 to Rt 85 South. From the Shoreline, take Rt. 95 to Rt. 85 North. Talk-in on 146.730(-). Bring your gear to sell (10% commission to RASON). Free admission, free parking. Contact *Mark KE1IU at (860) 536-9633; or see the RASON Web page at [www.rason.org].*

APRIL 8

STOUGHTON, WI The Madison Area Repeater Assn. will host the "Madison Swapfest" on April 8th at Mandt Community Center, Stoughton Junior Fair Grounds, South Fourth St., Stoughton WI. Free parking. Doors open at 8 a.m. Talk-in on 147.15. Tickets $4 in advance or $5 at the door. Tables $12–$15 each. Contact *Madison Area Repeater Assn., P.O. Box 8890, Madison WI 53708-8890. Tel. (608) 245-8890. Web site [http://www.qsl.net/mara/].*

SPECIAL EVENTS, ETC.

MARCH 17

MACON, GA The Macon ARC will operate W4BKM 1500–2200 UTC on Saturday, March 17th, at the 19th annual Cherry Blossom Festival in Macon. Phone 14.240, 21.335, and 28.390. For a certificate, send QSL and a 9 x 12 SASE to *Macon ARC, P.O. Box 4862, Macon GA 31208 USA.*

On the Go

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When signals bounce, there are many factors that determine where they can be received and no guarantees that both signals will travel the same path.

I heard a Canadian station check if the frequency was in use. I heard no other station on the frequency and apparently neither did he. He then began to call CQ and the response was immediate and brutal. As soon as he unkeyed the microphone he received a broadside from a number of stateside stations informing him that he was too near an ongoing QSO. The Canadian ham replied stating that he could hear a station but that it was too weak to copy. That evidently offended the stateside operators and they expressed their opinions quite freely. I decided to switch the rig off.

Notice that I have referred to these individuals as "operators" rather than hams. I feel that a ham sets and maintains certain standards and takes pride in his operating ability, his equipment, and himself. We used to have a name for these other operators. We used to call them lids. By whatever name, there seem to be a number of them out there.

But most hams are truly cut from a special bolt of cloth. I arrived in Omaha and set about concentrating on my new job, my temporary living arrangements and such, and haven't had much time to operate. When I have, though, I've had some great chats with the folks on the local repeaters who welcomed me, filled me in on the various repeaters, where they were, how they were linked and which ones would be best for use with an HT from my temporary QTH. I was invited to their weekly informal get-together.

What a difference! While I have focused on those whose operating practices were marginal, there are a lot of great folks on the band. To those, I say "thank you" for making a long trip more pleasant!

Homing In

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Resources

Hamtronics, Inc.
65-D Moul Road,
Hilton NY 14468-9535
(716) 392-9430
[http://www.hamtronics.com]

PicCon Transmitter Controller
Byon Garrabrant N6BG
8128 Kokoma Dr.
Las Vegas NV 89128
[http://www.byonics.com/piccon/index.html]

Montreal Fox Controller
Plans in "Homing In" for April 1998
[http://members.aol.com/joek0ov/mfcupdate.html]

Airtek Engineering
Ken Bauer KB6TTS
2306 Turquoise Circle
Chino Hills CA 91709
(909) 393-9889
[KenF1A@worldnet.att.net]

Magnum Telemetry
312 W. Queen St.
P.O. Box 1060
Grifton NC 28530
(252) 524-5391
[http://www.magnumtelemetry.com]

RFID Systems Page
[http://www.cwt.vt.edu/faq/rfid.htm]

The Digital Port

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I found several sites with the 2.5 download available. I have placed two of them in *The Chart*, and you will find there is a wealth of information and other software available at these URLs. Almost forgot to include one of the most important bits of info. One of the hangout frequencies for Throb is 28.080. After I learned that, I went there to monitor and found some MFSK16 activity. No Throb but that is promising. Most likely a digital watering hole worth checking into frequently.

We reported on the Stream software package in January and I just noticed that version 0.86 is available already. I checked the one in the computer, working very well indeed, and it is a lowly 0.83. I guess I just don't know how to keep up.

That's about it for this time around. Have fun. If you have questions or comments about this column, E-mail me [jheller@sierra.net]. I will gladly share what I know or find a resource for you. For now, 73, Jack KB7NO.

Jim Gray II
P.O. Box 22799
Juneau AK 99802

In Like a Lion

With Sunspot Cycle 23 peaking, it is very difficult to make accurate long-range solar predictions (this is being written at Christmastime), but I'm expecting intense activity for early March. DX conditions will probably not improve until the weekend of the 11th, so the first 10 days might be a good opportunity to finish those lingering winter projects, do the spring cleaning, and (gasp!) file the tax returns.

Solar activity should subside from the 11th to the 14th and provide the first good DXing in quite awhile. The 15th through the 25th look to be rather poor, and so may provide another chance to get away from the ham shack. A few quiet days should occur around the equinox, and a few more good days near the end of the month may provide the best DXing since the year began.

On an optimistic note, springtime is historically good for 15 and 20 meters and should yield some rare contacts, especially in Asia and the Indian Ocean. Also, be ready for those elusive Arctic and Antarctic contacts since the gray-line will extend over the poles this month. Long paths work best at sunset and short paths work best at sunrise. Good luck!

Band by Band Summary

10 and 12 meters

Use these as daytime-only bands. Most openings will be to the east in the morning and to the south or west from noon onward. The strongest signals will typically come from stations located in Western Europe or Japan. Expect less utility from 10 and 12 meters as warmer weather arrives and the maximum usable frequencies (MUFs) decrease. Short-skip distances will be between 1,000 and 2,500 miles.

15 and 17 meters

These are expected to be very good during the day and should even remain open into the evening at lower latitudes. Signals will peak toward the east in the morning, to the south around midday,

March 2001						
SUN	MON	TUE	WED	THU	FRI	SAT
				1 P	2 P	3 F-P
4 F-P	5 P	6 VP	7 P	8 P	9 F-P	10 F
11 F-G	12 F-G	13 G	14 G	15 F	16 P	17 P
18 P	19 F-P	20 F	21 F-G	22 F-G	23 P	24 P-F
25 F-P	26 F	27 F-G	28 G	29 G	30 F-P	31 F-P

EASTERN UNITED STATES TO:												
GMT	00	02	04	06	08	10	12	14	16	18	20	22
Central America	(15) 20	(15) 20	20 (40)	(20-40)	x	x	x	(10)	(10)	(10-15)	10 (17)	12-20
South America	(17) 20	20 (40)	20 (40)	(20-40)	x	x	x	(10)	(10)	(10-15)	10-15	10 (20)
Western Europe	(20-40)	(30-40)	(30-40)	(40)	x	x	(15-20)	(10-20)	(10)17	15-20	(15) 20	(20)
Southern Africa	(17) 20	(20-40)	(20)	(20)	x	x	x	x	(10)	10 (15)	12 (17)	(15-20)
Eastern Europe	x	(30-40)	(20-40)	(17-20)	(20)	x	x	(10-15)	(15)	(17-20)	(20)	(20)
Middle East	x	(20)	20	(20-40)	(40)	x	x	x	(10-15)	15	(17-20)	(20)
India/ Pakistan	(17-20)	x	x	x	x	x	x	(15-17)	x	x	x	x
Far East/ Japan	(17-20)	(20)	x	x	x	x	x	x	x	x	x	(15)
Southeast Asia	(17-20)	x	x	x	x	x	(17-20)	(10-15)	x	x	x	x
Australia	(15)	(17-20)	x	x	x	x	(20-40)	(20)	(10)	x	x	x
Alaska	(15) 20	(20)	(20-30)	(30-40)	(40)	x	x	x	(15-20)	(10-20)	(10)17	15-20
Hawaii	(15) 20	20	(20-40)	(20-40)	(40)	x	x	x	(15-20)	(10-20)	(10-20)	15-20
Western USA	15-20	20 (40)	20 (40)	(20) 40	(30-40)	x	x	(10-20)	10 (20)	10 (20)	10 (20)	(15) 20
CENTRAL UNITED STATES TO:												
Central America	(15-20)	20 (40)	20-40	20-40	(20-40)	x	(10-20)	10-20	10-20	10 (20)	10 (20)	10-20
South America	(15) 20	17-30	20 (40)	20 (40)	x	x	x	(10-20)	10 (20)	10 (15)	(10-20)	12 (20)
Western Europe	(20)	(40)	(40)	x	x	x	x	(15)	(15-17)	(15-20)	(17-20)	(20)
Southern Africa	20	(20)	(20)	(20)	x	x	x	x	(10)	(10-15)	(10-17)	(15-20)
Eastern Europe	(20)	(20)	x	x	x	x	x	(15)	(15-17)	(17-20)	(20)	(20)
Middle East	x	x	x	x	x	x	x	x	(15)	(15)	(20)	(20)
India/ Pakistan	(17-20)	(15-20)	x	x	x	x	x	(15-20)	x	x	x	x
Far East/ Japan	(17-20)	(20)	x	x	x	x	x	x	x	x	x	(15)
Southeast Asia	(15-20)	x	x	x	x	x	x	(20)	(10-20)	x	x	x
Australia	(15-20)	(20)	x	x	x	x	x	(15-20)	(15-20)	15	15	15 (20)
Alaska	15-20	(15) 20	20	20 (30)	(30-40)	(40)	x	x	x	(10-20)	10-20	10 (20)
Hawaii	15-20	(15) 20	20 (40)	(30-40)	(40)	x	x	x	x	(10) 12	10-15	(10) 17
WESTERN UNITED STATES TO:												
Central America	10-20	15-20	15-30	(14) 40	20-40	(30-40)	x	(15-20)	10 (20)	10 (20)	10 (20)	10 (20)
South America	(10) 20	(15) 20	20 (40)	20 (40)	x	x	x	(10-20)	10 (20)	(10-15)	10 (15)	10 (20)
Western Europe	x	x	x	x	x	x	x	x	(15-17)	(15-17)	(17-20)	(17-20)
Southern Africa	(20)	(20)	(20)	(20)	(20)	x	x	x	x	(10-12)	(12) 17	(15-20)
Eastern Europe	x	x	x	(17-20)	(17-20)	x	x	(15)	(15)	(15-17)	(17-20)	(20)
Middle East	x	(20)	(20)	x	x	x	x	x	(15-17)	(20)	(20)	(20)
India/ Pakistan	x	(17-20)	x	x	x	x	x	x	(15-17)	x	x	x
Far East/ Japan	10-20	(20)	x	x	x	(40)	(40)	x	x	x	x	(10-20)
Southeast Asia	(10-15)	(10-15)	x	x	x	x	x	x	x	(15-20)	(15-20)	(10-15)
Australia	(10-15)	(15)	(17-20)	x	x	x	x	x	(15) 20	(15-20)	(15)	(10)
Alaska	(10) 20	(15) 20	20 (40)	(20) 40	(30-40)	(40)	(40)	(40)	x	(10-15)	10-15	10-20
Hawaii	(15) 20	20	(20-40)	(20) 40	(30-40)	(40)	x	x	x	(10-20)	(10) 20	15-20
Eastern USA	15-20	20 (40)	20 (40)	(20) 40	(30-40)	x	x	(10-20)	10 (20)	10 (20)	10 (20)	(15) 20

Table 1. *Plain numerals indicate bands which should be workable on Fair to Good (F-G) and Good (G) days. Numbers in parentheses indicate bands usually workable on Good (G) days only. Dual numbers indicate that the intervening bands should also be usable. When one number appears in parentheses, that end of the range will probably be open on Good (G) days only.*

and to the west in the late afternoon. Try the polar paths at local noon for brief openings into central and southern Asia. Short-skip can be expected to be about 1,000 miles.

20 meters

The best overall band, this will provide the most hours of HF operation. Expect openings to begin after sunrise and last well into the evening. Look for some exotic contacts between sunset and midnight as day breaks over Central Asia and the Indian Ocean. Short skip will average between 500 and 2,500 miles.

30 and 40 meters

Best from late evening to sunrise. Activity on these bands is certain to decline as warm weather arrives and atmospheric noise increases. Africa, the Middle East, and Asia should provide some opportunities for those hunting exotic contacts. Short skip will be less than 1,000 miles during the day and greater than 750 miles at night.

The History of Ham Radio

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provided the right kind of pitch and whine to satisfy the critical ham in his quest to excel on the air.

By the characteristic frequency over the air, most ham stations were recognized without the usual QTH report. "I know the sound of his spark" was a common remark among hams.

After a station had its mechanical problems fairly well under control, the problem of decrement of the signal emitted received considerable attention. Specifications from the bureau in Washington decreed that the decrement could not, or should not, be higher than 0.2 when the energy was transferred to the antenna. Otherwise, the signal emitted would be unduly broad, with accompanying increased interference due to high damping.

What was this decrement all about? The subject was discussed at great lengths. It took front and center attention and was good for an argument anywhere, anytime. Decrement and how to meet its requirements waxed hot and furious from many podiums at conventions. Today you never hear the subject mentioned anymore.

Decrement, logarithmic decrement: Nobody knew very much about the subject, even though the Department of Commerce issued their well-known Bureau of Standards book entitled *Radio Instruments and Measurements #74,* on March 23, 1918. This gave technicians and engineers an in-depth documentation on the subject. Mr. B. West ex-8KEZ discussed spark dischargers at the St. Louis convention in 1920. In the course of his presentation, he was interrupted repeatedly by well-meaning listeners in the audience, as they confused the issue by introducing the "damping factor" and then wondering what was meant by *napierian.* The confusion usually brought down the house, and the heated discussion ended in a draw. Not even well-meaning intellectual cowhands from the western ranches knew what to make of these arguments and decided to leave well enough alone when they got back to their radio shacks.

So decrement, damping factor, impulse excitation, and increment — all these factors — were eventually solved by the usual "over-the-ether-waves-reporting" way — experimentally, with trial and error methods prevailing. It was understood that a low resistance (the lower the better) in the secondary discharge circuit gave a low decrement and allowed the energy to oscillate freely with consequent low heat loss. We seldom worried about impulse excitation anymore.

Our problems were put away for a while until the next convention came along. This was to be the First National American Radio Relay League super meeting at the Edgewater Beach Hotel in Chicago, to be reviewed in the next chapter.

We go back to our midnight operating hours when all is quiet and serene about the house. The ham does not want disturbances to interfere with his concentration on distant code from some far-off place. Besides, when the key is closed, the spark noise could disturb the neighbors, and any intruders into the privacy of the shack would be overcome by the ozone that often permeated the atmosphere. QRX 'til we meet later on, when fully recovered, in a fresh air environment.

To be continued.

QRX

continued from page 6

as possible. The original "old-timers" and Elmers are gone, and consequently a part of ham radio slowly continues to fade.

To help stop this attrition of information, all radio communications enthusiasts are invited to join and contribute whatever information they have to this unique Internet reflector.

To subscribe to the Ham Radio History reflector, simply send a blank E-mail to [ham-radio-subscribe@egroups.com].

Thanks to HRHR, via Newsline, *Bill Pasternak WA6ITF, editor.*

Cell Phones a Headache?

Children who use mobile phones risk suffering memory loss, sleeping disorders, and headaches. So says British physicist Dr. Gerard Hyland in research published in the medical journal *The Lancet.*

In his article, Dr. Hyland raises new fears over radiation caused by mobile phones. He says that those under 18 years old, who represent a quarter of Britain's 25 million mobile users, are also more vulnerable because their immune systems are less robust.

According to Dr. Hyland, radiation is known to affect brain rhythms and children are particularly vulnerable. Hyland says that if mobile phones were a type of food, they simply would not be licensed, because there is so much uncertainty surrounding their safety.

Thanks to RF Safety News, *via* Newsline, *Bill Pasternak WA6ITF, editor.*

Death On-line

According to a spokesperson in the FCC Licensing and Technical Analysis Branch in Gettysburg, the FCC now can accept a printed copy of information appearing on the Internet as adequate proof of death "provided the printout contains certain, verifiable, information." The Licensing Bureau also will accept a list — with supporting documentation — of multiple requests for cancellation of amateur licenses.

According to information on the FCC's vanity Web site, [www.fcc.govwtb/amateur/vnityfaq.html], individuals can report the death of a licensee by submitting a signed request for license grant cancellation accompanied by a copy of an obituary or death certificate to the Licensing Branch.

The FCC says it's been able to match up the name, address, and birth date of the deceased included on some submittals it's received via the Ancestry.com site [http:www.ancestry.com] on the Internet. "The validity of these printouts as proof of death is equal to the same level of sufficiency as an obituary, in terms of reducing the risk of the inadvertent cancellation of a valid amateur callsign," the FCC spokesperson said.

Thanks to Jennifer Hagy N1TDY, via Newsline, *Bill Pasternak WA6ITF, editor.*

NEVER SAY DIE

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No, this isn't ham radio stuff... but then, I've been asking you to get busy and write about any adventures the hobby has given you so I'd be able to use them in the magazine, and then publish them in a book to help clubs get youngsters interested in the hobby.

We need kids. We need 'em desperately. And what's happened to our school system is a big part of our problem in attracting kids.

Becoming What We Are by Robert Anton Wilson

If you stroll through a large art museum, you will notice that Van Gogh does not paint the same world as Rembrandt, Picasso does not see things the way Goya did, Georgia O'Keeffe doesn't much resemble Rivera, Salvador Dali looks like nobody but himself, and, in general, no world-class artist became a "classic" by doing what somebody else had already done or even what everybody else in his/her own era did.

And in science, the names of Einstein, Dirac, the Curies, Bohr, Heisenberg, Schroedinger, John Bell, etc., live on because none of them took Newton as Holy Gospel: They all made unique and unpredictable innovations in basic theory.

And, in case you think this applies only to "arts and sciences," consider the most successful people in industry. Henry Ford did not get rich copying Fulton's steamboat; he made a car so cheap that anybody could afford one.

Howard Hughes produced movies that nobody else would have dared to attempt, and then went on to revolutionize the airline industry. Buckminster Fuller did not copy the cubical form of previous architects, but invented the geodesic dome; at last count, over 300,000 of his buildings existed, making him the most visibly successful architect in history. Steve Wozniak did not copy the computers of his day, but invented one that even an "bloody eejit" (like me) could use (and even enjoy!). Etc.

We all need constant reiteration of these truisms because we live in a world where a multitude of very powerful forces have worked upon us, from birth through school to work, attempting to suppress our individuality, our creativity, and, above all, our curiosity — in short, to destroy everything that encourages us to think for ourselves.

Our parents wanted us to act like the other children in our neighborhood; they emphatically did not want a boy or girl who seemed "weird" or "different" or (Heaven forfend!) "too damned clever by far."

Then we enter grade school, a fate worse than Death and Hell combined. Whether we land in a public school or a private religious school, we learn two basic lessons: (1) there exists one correct answer for every question; and (2) education consists of memorizing the one correct answer and regurgitating it on an "examination."

The same tactics continue through high school and, except in a few sciences, even to the university.

All through this "education" we find ourselves bombarded by organized religion. Most religions in this part of the world also teach us "one correct answer," which we should accept with blind faith; worse, they attempt to terrorize us with threats of postmortem roasting, toasting, and charbroiling if we ever dare to think at all, at all.

After 18 to 30+ years of all this, we enter the job market, and learn to become, or try to become, almost deaf, dumb, and blind. We must always tell our "superiors" what they want to hear, what suits their prejudices and/or their wishful fantasies. If we notice something they don't want to know about, we learn to keep our mouths shut. If we don't — "One more word, Bumstead, and I'll fire you!"

As my mahatmaguru J.R. "Bob" Dobbs says, "You know how dumb the average guy is? Well, mathematically, by definition, half of them are even dumber than that."

"Bob" may have the average confused with the median, but otherwise he hit a bull's-eye. Half of the people you meet do indeed seem dumber than a box of rocks; but they did not start out that way. Parents, peers, schools, churches, advertisers, and jobs made them that way. Every baby at birth has a relentlessly curious and experimental temperament. It takes the first third of our lives to destroy that curiosity and experimentalism; but in most cases, we become placid parts of a docile herd.

This human herd all started out as potential geniuses, before the tacit conspiracy of social conformity blighted their brains. All of them can redeem that lost freedom, if they work at it hard enough.

I've worked at it for 50+ years now, and still find parts of me acting like a robot or a zombie on occasion. Learning "how to become what you are" (in Nietzsche's phrase) takes a lifetime, but it still seems the best game in town.

Wilson will be speaking at The Prophets Conference in New York City on May 18–20, 2001. For information check: [http://www.greatmys tery. org]. Or call toll-free 1-888-777-5981.

The *Secret Guide to Wisdom* is my effort to help people regain the freedom our schools have taken away from them.

Gun Control

Yes, kids shooting kids is terrible. Anyone shooting anyone sucks. In the case of kids, just as our doctors do their best to tackle the symptoms caused by poisons and bad nutrition with pills, shots, surgery, radiation, and so on, the media (and the unthinking public, unfortunately) want to try to keep guns out of the hands of people instead of eliminate what's been causing the problem.

There have been any number of attempts to control guns, but sadly, the gun nuts are right: When you outlaw guns, only the outlaws have guns. In every case where a community has confiscated the public's guns, there has been a substantial resulting increase in crime.

If you were making your living as a burglar, would you rob houses in towns where you might be faced with an angry home owner with a shotgun, or would you head for a town where all of the guns had been confiscated?

Last year, at a cost of over $500 million, Australia confiscated over 600,000 firearms and crushed them. And that included some beautiful collector's items. In the 12 months since then, homicides are up 3.2%, muggings up 8.4%, and armed robberies up 44%. In the state of Victoria alone, homicides using guns are up 300%.

Until the government confiscation of firearms, there had been a steady 25-year drop in homicides using guns.

Our Universities

Defenders of the American school system claim that our universities are among the highest-rated in the world, and that Americans regularly win a high percentage of Nobel Prizes. Yes, Americans *did* win the most Nobel Prizes last year, but *none* of the winners were born here. They were all naturalized citizens.

Hmm, how come not one native American won a prize? For that matter, did you know that less than half of the Ph.D.s in engineering and math are received by Americans? The fact is that youngsters educated in American schools and colleges just can't compete with the foreign-educated students. As American public school test scores have plummeted, more and more foreign students have been displacing Americans in our top universities, and the worst declines have been in the most demanding subjects, such as science. We're training sociologists, when the world is demanding engineers, programmers, and scientists.

Continued on page 64

Wise Up!

Here are some of my books which can change your life (if you'll let 'em). If the idea of being healthy, wealthy and wise interests you, start reading. Yes, you can be all that, but only when you know the secrets which I've spent a lifetime uncovering.

......Wayne

The Bioelectrifier Handbook: This explains how to build or buy ($155) a little electrical gadget that can help clean the blood of any virus, microbe, parasite, fungus or yeast. The process was discovered by scientists at the Albert Einstein College of Medicine, quickly patented, and hushed up. It's curing AIDS, hepatitis C, and a bunch of other serious illnesses. The circuit can be built for under $20 from the instructions in the book. $10 (#01)

The Secret Guide to Wisdom: This is a review of around a hundred books that will help you change your life. No, I don't sell these books. They're on a wide range of subjects and will help to make you a very interesting person. Wait'll you see some of the gems you've missed reading. $5 (#02)

The Secret Guide to Wealth: Just as with health, you'll find that you have been brainwashed by "the system" into a pattern of life that will keep you from ever making much money and having the freedom to travel and do what you want. I explain how anyone can get a dream job with no college, no résumé, and even without any experience. I explain how you can get someone to happily pay you to learn what you need to know to start your own business. $5 (#03)

The Secret Guide to Health: Yes, there really is a secret to regaining your health and adding 30 to 60 years of healthy living to your life. The answer is simple, but it means making some difficult lifestyle changes. Will you be skiing the slopes of Aspen with me when you're 90 or doddering around a nursing home? Or pushing up daisies? No, I'm not selling any health products. $5 (#04)

My WWII Submarine Adventures: Yes, I spent from 1943-1945 on a submarine, right in the middle of the war with Japan. We almost got sunk several times, and twice I was in the right place at the right time to save the boat. What's it really like to be depth charged? And what's the daily life aboard a submarine like? How about the Amelia Earhart inside story?If you're near Mobile, please visit the Drum. $5 (#10)

Wayne's Caribbean Adventures: My super budget travel stories – where I visit the hams and scuba dive most of the islands of the Caribbean. You'll love the special Liat fare which let me visit 11 countries in 21 days, diving all but one of the islands. Guadeloupe, where the hams kept me too busy with parties. $5 (#12)

Cold Fusion Overview: This is both a brief history of cold fusion, which I predict will be one of the largest industries in the world in the 21st century, plus a simple explanation of how and why it works. This new field is going to generate a whole new bunch of billionaires, just as the personal computer industry did. $5 (#20)

Cold Fusion Journal: They laughed when I predicted the PC industry growth in 1975. PCs are now the third largest industry in the world. The cold fusion ground floor is still wide open, but then that might mean giving up watching ball games. Sample: $10 (#22).

Julian Schwinger: A Nobel laureate's talk about cold fusion—confirming its validity. $2 (#24)

Improving State Government: Here are 24 ways that state governments can cut expenses enormously, while providing far better service. I explain how any government bureau or department can be gotten to cut it's expenses by at least 50% in three years and do it cooperatively and enthusiastically. I explain how, by applying a new technology, the state can make it possible to provide all needed services without having to levy *any* taxes at all! Read the book, run for your legislature, and let's get busy making this country work like its founders wanted it to. Don't leave this for "someone else" to do. $5 (#30)

Mankind's Extinction Predictions: If any one of the experts who have written books predicting a soon-to-come catastrophe which will virtually wipe most of us out are right, we're in trouble. In this book I explain about the various disaster scenarios, like Nostradamus, who says the poles will soon shift (as they have several times in the past), wiping out 97% of mankind. Okay, so he's made a long string of past lucky guesses. The worst part of these predictions is the accuracy record of some of the experts. Will it be a pole shift, a new ice age, a massive solar flare, a comet or asteroid, a bioterrorist attack? I'm getting ready, how about you? $5 (#31)

Moondoggle: After reading René's book, *NASA Mooned America*, I read everything I could find on our Moon landings. I watched the videos, looked carefully at the photos, read the astronaut's biographies, and talked with some of my readers who worked for NASA. This book cites 25 good reasons I believe the whole Apollo program had to have been faked. $5 (#32)

Classical Music Guide: A list of 100 CDs which will provide you with an outstanding collection of the finest classical music ever written. This is what you need to help you reduce stress. Classical music also raises youngster's IQs, helps plants grow faster, and will make you healthier. Just wait'll you hear some of Gotschalk's fabulous music! $5 (#33)

The Radar Coverup: Is police radar dangerous? Ross Adey K6UI, a world authority, confirms the dangers of radio and magnetic fields. $3 (#34)

Three Gatto Talks: A prize-winning teacher explains what's wrong with American schools and why our kids are not being educated. Why are Swedish youngsters, who start school at 7 years of age, leaving our kids in the dust? Our kids are intentionally being dumbed down by our school system — the least effective and most expensive in the world. $5 (#35)

Aspartame: a.k.a. NutraSweet, the stuff in diet drinks, etc., can cause all kinds of serious health problems. Multiple sclerosis, for one. Read all about it, two pamphlets for a buck. (#38)

One Hour CW: Using this sneaky booklet even *you* can learn the Morse Code in one hour and pass that dumb 5wpm HF entry test. $5 (#40)

Code Tape (T5): This tape will teach you the letters, numbers and punctuation you need to know if you are going on to learn the code at 13 or 20 wpm. $5 (#41)

Code Tape (T13): Once you know the code for the letters (#41) you can go immediately to copying 13 wpm (using my system). This should only take a couple of days. $5 (#42)

Code Tape (T20): Or, you can start right out at 20 wpm and master it in a weekend. $5 (#43)

Wayne Un-Dayton Talk: This is a 90-minute tape of the talk I'd have given at the Dayton, if invited. $5 (#50)

Wayne Tampa Talk: This is the talk I gave at the Tampa Global Sciences conference—where I cover amateur radio, cold fusion, health, books you should read, and so on. $5 (#51)

$1 Million Sales Video: The secret of how you can generate an extra million dollars in sales just by using PR. This will be one of the best investments you or your business will ever make. $40 (#52)

Reprints of My Editorials from *73*. Very few things in this world are as we've been taught, and as they appear. I blow the whistle on the scams around us, such as the health care, our school system,. our money, the drug war, a college education, sugar, the food giants, our unhealthy food, fluorides, EMFs, NutraSweet, etc.

1996 Editorials: 120 pages, 100 choice editorials. $10 (#72)

1997 Editorials: 148 fun-packed pages, 216 editorials. $10 (#74)

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1999 Editorials: 132 pages of ideas, book reviews, health, education, and anything else I think you ought to know about. $10 (#76)

2000 Editorials: In the works.

Silver Wire: With two 3-in. pieces of heavy pure silver wire + three 9V batteries you can make a thousand dollars' worth of silver colloid. What do you do with it? It does what the antibiotics do, but germs can't adapt to it. Use it to get rid of germs on food, for skin fungus, warts, and even to drink, Read some books on the uses of silver colloid, it's like magic. $15 (#80)

Wayne's Bell Saver Kit. The cable and instructions enabling you to inexpensively tape Art Bell W6OBB's nightly 5-hr radio talk show. $5 (#83)

NH Reform Party Keynote Speech. It wow'd 'em when I laid out plans for NH in 2020, with much better, yet lower-cost schools, zero state taxes, far better health care, a more responsive state government, etc. $1 (#85)

Stuff I didn't write, but you need:

NASA Mooned America: René makes an air-tight case that NASA faked the Moon landings. This book will convince even you. $25 (#90)

Last Skeptic of Science: This is René's book where he debunks a bunch of accepted scientific beliefs – such as the ice ages, the Earth being a magnet, the Moon causing the tides, and etc. $25 (#91)

Dark Moon: 568 pages of carefully researched proof that the Apollo Moon landings were a hoax—a capping blow for René's skeptics. $35 (#92)

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Turn your old ham and computer gear into cash now. Sure, you can wait for a hamfest to try and dump it, but you know you'll get a far more realistic price if you have it out where 100,000 active ham potential buyers can see it, rather than the few hundred local hams who come by a flea market table. Check your attic, garage, cellar and closet shelves and get cash for your ham and computer gear before it's too old to sell. You know you're not going to use it again, so why leave it for your widow to throw out? That stuff isn't getting any younger!

The *73* Flea Market, Barter 'n' Buy, costs you peanuts (almost)— comes to 35 cents a word for individual (noncommercial!) ads and $1.00 a word for commercial ads. Don't plan on telling a long story. Use abbreviations, cram it in. But be honest. There are plenty of hams who love to fix things, so if it doesn't work, say so.

Make your list, count the words, including your call, address and phone number. Include a check or your credit card number and expiration. If you're placing a commercial ad, include an additional phone number, separate from your ad.

This is a monthly magazine, not a daily newspaper, so figure a couple months before the action starts; then be prepared. If you get too many calls, you priced it low. If you don't get many calls, too high.

So get busy. Blow the dust off, check everything out, make sure it still works right and maybe you can help make a ham newcomer or retired old timer happy with that rig you're not using now. Or you might get busy on your computer and put together a list of small gear/parts to send to those interested?

Send your ads and payment to: *73 Magazine*, Barter 'n' Buy, 70 Hancock Rd., Peterborough NH 03458 and get set for the phone calls. The deadline for the May 2001 classified ad section is March 10, 2001.

NEVER SAY DIE

continued from page 62

Today's leaders in science and technology are people who haven't been dumbed down by our American public schools and colleges.

When New Hampshire was awash in presidential hopefuls, all claiming they're going to improve American schools, it's interesting that not one of them offered *any* actual proposals for doing this. Of course, they don't dare; otherwise, they'd have the teachers' unions fighting them, while generously funding their competitors.

Is the situation hopeless? Hey, that's up to you! I've explained how you can help solve this misery, but I can't seem to get your attention.

APRIL 2001
ISSUE #485
USA $3.95
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THE NEW!

73 Amateur Radio Today

Sabah 9M6: Land Below the Wind

Spiderman Antenna

Rocket Telemetry Blastoff!

Disaster Overkill

Decibels for Dummies

First Avian QSO
(see page 64)

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THE NEW! 73® Amateur Radio Today

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QRX . . .

ARRL Reverses Position on CW (er ... well ... kinda ... sorta ...)

The ARRL Board of Directors has partially revised its position on Morse Code proficiency.

The League's own news release said that the Board approved a resolution that both recognizes and accepts as being likely that the Morse requirement will be dropped from Article S25 of the international Radio Regulations. They even admit that this could happen as soon as the 2003 World Radiocommunications Conference. But while the ARRL leadership acknowledges that Morse will probably disappear as an international requirement, it held the line on retaining a domestic Morse requirement.

The bottom line, says the ARRL Board: Each country must be allowed to determine for itself whether or not it wants to have a Morse code requirement.

As far as keeping Morse testing here in the United States goes. the Board's resolution says that any future deletion of the Article S25 international requirement should not automatically or immediately mean a similar removal of the code tests from Part 97 of the FCC rules. Morse code, the Board says, deserves continued support as an important operating mode

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NEVER SAY DIE

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Mooned

I hope you didn't miss seeing the Feb. 15th Fox TV special program on NASA's Moon landing hoax.

For those of you who've considered me crazy for being convinced that NASA faked all of the Moon landings, this program must have been a terrible shocker.

A while back Ralph René sent me a copy of his *NASA Mooned America*. Since I am known to have no problem with being controversial, I get a lot of weird books to review. And, every now and then, one of them makes sense.

The whole idea that the biggest American accomplishment of the century might have been totally faked was far out. But, when I read René's book, it made sense. For instance, NASA's photos of the LEM on the Moon, with there being no hint of any burn marks under it where the rockets should have made a hole and blasted away the dust, was a shocker. Instead, there was undisturbed dust under it. And René had a long list of serious discrepancies, plus a list of the 13 astronauts in the program who mysteriously died just at the time they would have been ordered to go along with the fakery.

If you're interested in becoming unignorant on the subject, you can order René's book ($30) from my Web site, [www.waynegreen.com]. Normally I don't sell the books I review, but where there is no other source and the book is important, so what the hell.

My interest piqued, I read Bill Kaysing's *We Never Went to the Moon*, which made an even stronger case for the hoax. Then, Brian's *Moongate*, for more data. These two books are out of print, as far as I know, elst I'd make them available.

More recently, *Dark Moon*, by David Percy, was published in London. This 568-page, 7- x 10-inch, profusely illustrated $35 book goes into great detail on the cameras, film, space suits, and so on—leaving no wiggle room for anyone wanting to believe that we really did land men on the Moon. Yes, I'm importing the book to make it available in America.

Kaysing, who was an engineer for Rocketdyne, the company that developed the motors for NASA, pointed out that they'd tried five times to make big enough rocket engines to get men to the Moon, and all had failed. The engines used for the supposed Apollo trips didn't have near enough power to loft the needed load. Smaller engines were used, with some kerosene added to make bigger flames.

Percy measured the LEM's hatch and found it much too small for the astronauts in their space suits to get through. And so it went for endless contradictions—like the silent background when the LEM was coming in for a landing on the Moon. At the time the LEM's rocket engine was slowing it down for the landing, and a rocket engine is not a quiet beast, it makes a hell of a noise—yet the only sound from inside the LEM was the astronaut talking to Houston as they landed.

And what did the NASA spokesman have to say about the many points brought up on the TV show? He had no answer for anything, except that anyone who doesn't believe we went to the Moon is a nut.

A chap who seemed to know the inside of what had gone on called me after the show and suggested that I get some Russian satellite photos of Alice Springs (in the Australian outback) and look for the huge geodesic dome where the Moon photos were taken.

If you do run into a true NASA believer, ask them to ponder *this* data: According to NOAA reports, the x-ray radiation in space beyond the Van Allen Belt is 0.1 rads per second, and that doesn't count the added radiation from Sun flares, which are a daily occurrence. Also, it takes an average of 3.2 rads per second from the Sun hitting the Van Allen Belt to keep it charged. So, just with the 0.1 rad x-rays in space the astronauts on a 12-day trip to the Moon and back would absorb over 100,000 rads. Yet 500 is a lethal dose.

Plus the much higher radiation picked up going through the Van Allen Belt twice, and any solar flare radiation.

Please ask NASA or any of their disinformation agents to explain that.

René was furious. After some six hours of interviews on video for the show he only got a couple of minutes on the air.

Couple-a-Quotes

"Whoever looks at all of the evidence and believes we went to the Moon is either in denial or is part of the disinformation—it's incredibly obvious that we didn't go!"—Bob Norberg K6BZM.

"I have been using the Plant Growth Stimulator for 16 days and have found, like others, that my weight is going down and, more importantly, I have a lot more energy."—Mike Hughes, Snohomish WA.

"I have an MBA and a master's degree in industrial engineering. I agree that most of the time in college is wasted—no useful learning occurs there!"—Bill Higgins, Woodinville WA.

Still Another Cover-up?

Maybe you missed the *20/20* program about the Oklahoma City bombing cover-up.

They interviewed several people who saw an Oklahoma County Bomb Squad truck across the street from the Murrah Building just before the blast. One witness said he saw paramilitary Bomb Squad personnel searching the outside of the courthouse across the street before the blast. He also said he'd seen several fire trucks heading toward the Murrah Building just before the blast.

Contrary to official denials, *20/20* established that the Oklahoma City Fire Department had gotten a call from the FBI five days before the bombing to be on the lookout for suspicious people. And *20/20* quoted an official government document confirming that the Department of Justice in Washington had received a phone call 24 minutes before the bombing saying that the Murrah Building had just been bombed.

By a strange coincidence (think of the odds!), the ATF

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as well as in terms of spectrum conservation. The ARRL leadership says it believes that Morse testing should be retained in the United States. It also calls on it's headquarters staff to develop a program designed to promote the use of the code.

This new resolution superseded all previous Board policy statements regarding Morse code and Article S25. It also means the ARRL will not vote against proposals at the International Amateur Radio Union Region 2 Conference next October or at WRC 2003. It's the latter conference which might call for elimination of the Morse testing requirement from the international radio regulations.

What does this change of position mean for the United States ham radio community? Nothing immediate. Many countries, including the United States, have already lowered their Morse code requirements to 5 words per minute, and others are expected to do so shortly. Also, with it being less than a year since restructuring of the United States Amateur Radio Service was implemented, there is little chance that the issue of Morse testing to come up as an FCC regulatory matter before 2004 at the earliest.

The ARRL's decision to no longer oppose the elimination of Morse code as an international ham radio licensing requirement has not caused much excitement among the rank and file in the United States amateur radio community. At least not among hams who actually operate their stations.

Judging by on-the-air comments monitored by Newsline, those US hams who discuss the matter seem to have expected the League's Board of Directors to accept as inevitable the abolition of the international licensing rule that calls for Morse testing. This, as nation after nation makes known its decision to vote in favor of dropping international radio regulation S25 at the next World Radiocommunications Conference slated for 2003.

In fact, you have to go to the Internet newsgroups to find any real debate or controversy. There, the troops are as usual polarized both for and against the initiative — but even more so than before the recent announcement. Comments range from the ridiculous to the sublime, but there is no way to really derive a consensus from what's being posted.

And, as has so often been pointed out, the Internet, and especially the newsgroups, are not Amateur Radio. Also, the hams without radios who live there have little to say regarding the future of the United States Amateur Radio Service.

Thanks to Roy Neal K6DUE, via Newsline, *Bill Pasternak WA6ITF, editor.*

You Be the Judge

At its first meeting of 2001, held just outside Dallas, the ARRL Board of Directors voted to increase its annual membership dues. The rate for a full member under age 65 rises from $34 to $39. Those over 65 will now pay $34 — up from $28. The dues hike goes into effect July 1, 2001.

Let's see: If you're under 65, that will be 56% more than your "dues" to *73*. Over 65? 36% more.

And which provides you with more fun?

Baffling Batteries of Babylon

Who invented the first battery? Most of you will probably say that the battery is a product of modern times. So you will probably be shocked — no pun intended — shocked to learn that the electric storage battery may date back almost to antiquity.

In 1938, Dr. Wilhelm Konig, an Austrian archaeologist rummaging through the basement of the Baghdad Museum, made a find that was to drastically alter all concepts of ancient science.

A 6-inch-high pot of bright yellow clay dating back two millennia contained a cylinder of sheet copper 5 inches by 1.5 inches. The edge of the copper cylinder was soldered with a 60-40 lead-tin alloy comparable to today's best solder. The bottom of the cylinder was capped with a crimped-in copper disk and sealed with bitumen or asphalt. Another insulating layer sealed the top and also held in place an iron rod suspended into the center of the copper cylinder. The rod showed evidence of having been corroded with acid.

Dr. Konig recognized that this configuration was not a chance arrangement, but that the clay pot was nothing less than an ancient electric battery. The ancient battery in the Baghdad Museum, as well as others which were unearthed in Iraq, all date from the Parthian Persian occupation between 248 B.C. and A.D. 226!

Of course, the discovery of these ancient batteries gives rise to another question: If such cells existed before the birth of Christ, what did they power?

Thanks to Graham Kemp VK4BB, via Q-News Australia, *via* Newsline, *Bill Pasternak WA6ITF, editor.*

20-Year Flywheel?

One controversial technology debate now making the news centers on using flywheels as a power source. Now, an actual flywheel system is available from a company called Beacon Power Corporation.

Beacon Power targets its product at cable television, telephone, broadband, cellular, and PCS applications. Because garden-variety storage batteries need to be replaced every two to three years, Beacon Power says that a flywheel with a 20-year life span can yield impressive cost savings. Read more about Beacon Power by going to [www.beaconpower.com].

Thanks to Newsline, *Bill Pasternak WA6ITF, editor.*

Caching On

Those high-tech Christmas gifts may add more people to a new techno-adventure that is luring computer geeks away from their computer screens and into the real world. Called geocaching, the game takes players from mountaintops to cities, deserts to forests, hunting for a treasure cache, while relying only on the satellite-based Global Positioning System to lead the way.

Rather than counting on the treasure hunting maps of years past, geocaching players use GPS navigation devices to help them find carefully hidden containers full of trinkets. The prizes are secreted everywhere from forests to deep within cities.

According to Jeremy Irish, who runs a geocaching Web site, the motivation for the game is just being able to use the technology. You can find out more at [www.geocaching.org].

Thanks to Newsline, *Bill Pasternak WA6ITF, editor.*

Cola IS It!

Are the following points "the real thing," or just urban myths/suburban legends? Either way, no wonder a certain brand of cola tastes soooo good:

1. In many states (in the USA), the highway patrol carries two gallons of cola in the truck to remove blood from the highway after a car accident.
2. You can put a T-bone steak in a bowl of cola and it will be gone in two days.
3. To clean a toilet: Pour a can of cola into the toilet bowl, let the "real thing" sit for one hour, then flush clean. The citric acid in cola removes stains from vitreous china.
4. To remove rust spots from chrome car bumpers: Rub the bumper with a crumpled-up piece of Reynolds Wrap aluminum foil dipped in cola.
5. To clean corrosion from car battery terminals: Pour a can of cola over the terminals to bubble away the corrosion.
6. To loosen a rusted bolt: Apply a cloth soaked in cola to the rusted bolt for several minutes.
7. To bake a moist ham: Empty a can of cola into the baking pan, wrap the ham in aluminum foil, and bake. Thirty minutes before the ham is finished, remove the foil, allowing the drippings to mix with the cola for a sumptuous brown gravy.
8. To remove grease from clothes: Empty a can of cola into a load of greasy clothes, add detergent, and run through a regular cycle. The cola will help loosen grease stains. It will also clean road haze from your windshield.

FYI:

1. The active ingredient in the most popular cola is phosphoric acid. Its pH is 2.8. It will dissolve a nail in about 4 days.

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LETTERS

From the Ham Shack

Brian Lawn ZL2AJS, New Zealand. A neighborly ham, Ian ZL2IH, lent me a copy of your magazine, the July 1999 issue, number 465. He knew I would be interested in the "Long Beach Longwire" article by Hank WB6MEU.

About two-plus years ago, I tried the same wire (electric fencing wire) in a G5RV configuration and found that it worked well. In particular, it is very handy as a light and compact portable antenna.

Not long after that, another neighborly ham, Greg ZL2BZH, stopped by, saw this antenna, and grabbed my multimeter. Ah-ha, about 16 ohms per meter (6 stainless strands of course). In a G5RV, this equates to about 248 ohms per leg. Seemed to be as good as good copper wire. He was reasonably sure that the resistance was better than some commercial high resistance wire he had.

That reel of Polywire was about $12 (NZ$) for a 200m roll. So I went back to the local "Stock Firm" (the name usually given to a farmers' retail outlet) and had a good look at the labels on the other types of wire. I found a more suitable wire — the same basic material as the Polywire, possibly stronger, but now called "Turbo Wire." This has 9 strands, of which 6 are stainless and three, coated copper. This is stated to have 130 ohms per kilometer (209 ohms per mile). Greg and I shared a 40m roll — it was about twice the price of the Polywire.

My main antenna is a G5RV from TV ribbon and Turbo Wire which has stood more than two years of coastal weather. Of course, I have a portable system of the same material and configuration. For portable use, I also use very thin 50 ohm coax.

There are a number of members of our club (New Plymouth Branch 27 of NZART) who do not really believe that the system works. One particular member was operating during the last JOTA with the club rig and my portable G5RV, the center of which was about 7 meters up and the ends tied onto a fence. He had a satisfactory — maybe as good as with his beam at home — contact with South Africa! I did see him look strangely at the mike and say "IT WORKS!"

The Turbo Wire does perform better than the Polywire, but there is not much in it. By the way, the fine print on the label reads: Gallagher Power Fence Systems, Private Bag 3026, Hamilton, New Zealand.

Louis L. D'Antuono WA2CBZ, 8802 Ridge Blvd., Brooklyn NY 11209. I'm looking for references to articles written about New York City's Radio Row on Cortlandt St. Can anybody help? Thanks ...

Noel P. Larson WØCXR, 11423 Sorenson Lake Rd., Merrifield MN 56465. I need some help that I hope your readers can provide. I have a number of the Heathkit line of monobanders that I am collecting, and of course some of them are in need of some repair. In the accompanying schematic detail, perhaps you can see T4, which is between V12A and the 8-ohm speaker.

First, what would be a suitable replacement? Otherwise, I will have to rewind it (I really hate to admit this, but it has been a little over 50 years since I have wound a transformer). What would be the proper wire to rewind with? Thank you very much.

Les Warriner WA7HAM [leswa7ham @bentonrea.com]. It really is starting to blow my mind, the capabilities of computers on the ham bands with only a sound card in the computer to interface the transceiver and computer and make intelligence. Used to was that we had to have big clumsy chassis full of tubes and components to make intelligence out of the different available transmitting modes. Then we went to the TNCs and now we are down to a sound card, almost any of them will work from $16.95 and up, and a couple of cables.

I am now working Pactor, RTTY, PSK31, CW, and a couple of other "antique" modes such as Hellschreiber with only this setup. 40 watts from the Pegasus to an MFJ all-band vertical and working Europe on 10 meters every day.

Working Japan is about the same as working Oregon — no challenge.

When I worked at Boeing on the 747 computer systems, a guy there holding a Ph.D. in Computer Science was trying to explain to us and show us how to filter signals with software, and it worked. Many of his innovations are flying daily in those birds. And a lot of these same methods are being used by hams in developing software for the various communications modes. And they work!!

I guess that I am not a true ham nor do I enjoy motormouthing to various and sundry stations comparing the latest surgeries and such. It is a lot of fun, however, and worth every hour spent to get into these new modes and experiment with them. RTTY

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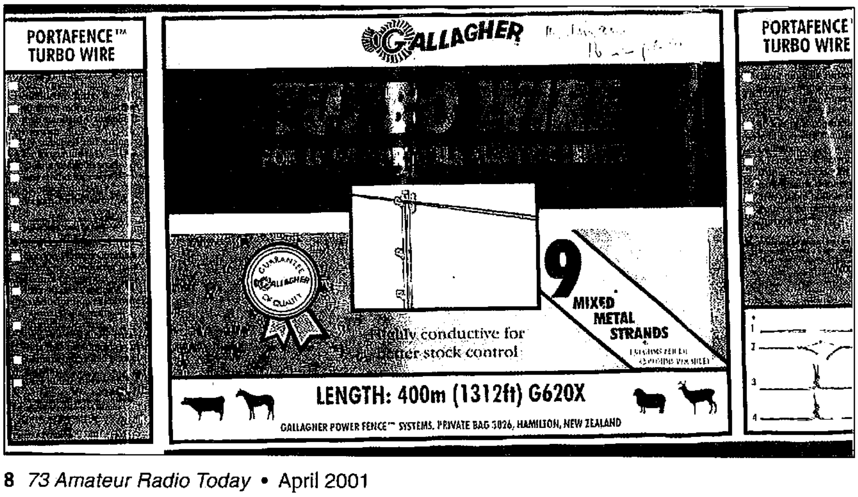

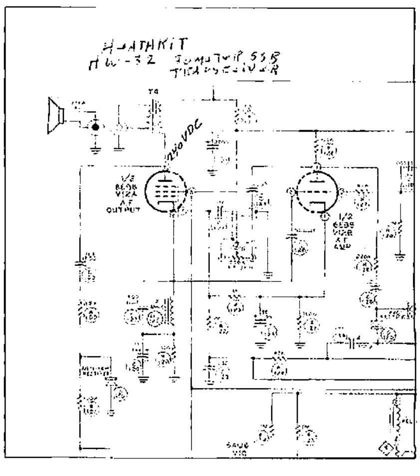

Phil Whitchurch G3SWH
21 Dickensons Grove
Congresbury
Bristol BS49 5HQ
England UK

Sabah — Land Below the Wind

Come along on this DXpedition to 9M6 ...

After a 14-hour flight via Kuala Lumpur, Jan and I arrived at Kota Kinabalu International Airport at 11:30 p.m. It was raining, as only it can in Southeast Asia. Transport for the ten-minute journey to the Shangri-La Tanjung Aru Hotel was waiting, and we very quickly checked into room 428 and went to bed.

It was still raining the following morning, but I lost no time in getting organized. Thanks to the good offices of Phil Weaver 9M6CT, VS6CT, HSØ/G4JMB, and Godfrey Yin 9M6GY, the ground had been well prepared. Our top floor room had a west-facing balcony, overlooking about 100 meters of lawn to the sea. My temporary license as 9M6PWT had been issued well in advance, and I had a fax from the hotel giving me permission to set up my antenna. The hotel could not have been more helpful, even making one of its staff available to assist me in rigging the antenna. There was a strategically placed palm tree on the lawn, so an antenna running east/west at about 10 meters high seemed to be the most practical arrangement. It was a simple exercise to get a halyard over the palm tree and to rig the simple dipole between the balcony and the tree, with band changing being effected by lowering the antenna and changing crocodile clips to lengthen or shorten it.

Photo A. Lunch on the first day: Kazu JA1RJU, Godfrey 9M6GY, Phil G3SWH, and XYL Jan.

While I was outside, Phil Weaver phoned to say that he would be picking us up at 11 a.m. to show us round the town. Godfrey also phoned to invite us to lunch. I managed to get the station, an Icom IC-706 transceiver, switched mode power supply, and 486-based laptop computer running CT, set up on the balcony and to make the first QSO with RWØSQ on 12 meters CW at 02:11 UTC on 4 November 1999, although the other bands didn't look too lively.

It was raining again by the time Phil collected us and gave us the conducted tour of Kota Kinabalu, the state capital and locally known as KK. Arriving at Godfrey's home, we were introduced to his wife, Stella 9M6JY, and handed a formal invitation to dinner that evening as guests of the Sabah Amateur Radio Society. We were joined for lunch by Donald Soh 9M6SU, and by Kazu JA1RJU, 9M6JU, both of whom had been on the 1998 expedition to the Spratly Islands 9MØC. Kazu was visiting KK to operate on 50 MHz from a flat on the top of a 15-story building.

Phil dropped us back at the hotel in the late afternoon and arranged to collect us again at 6:30 p.m. to take us to

Photo B. Dinner with SARS. Back, L–R: Augustine 9W6AN, Stella 9M6JY, Godfrey 9M6GY, Ho 9W6HC, Patrick 9M6PK, Lu 9W6LU, Richard 9M6RC. Seated, L–R: Phil 9M6CT, Kazu JA1RJU, Lawrence 9M6LK, XYL Jan, Phil G3SWH.

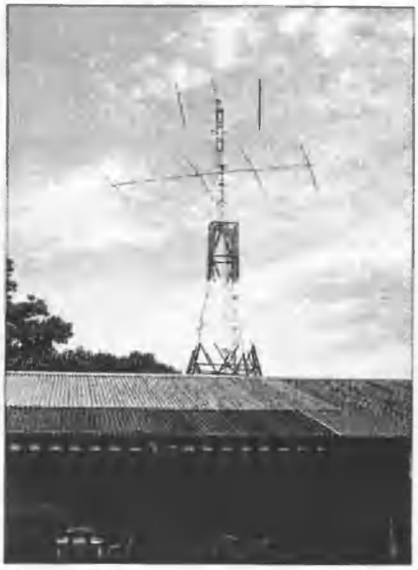

Photo C. The antennas at 9M6AAC.

dinner. I managed an hour or so on the air, but activity on 12 and 20 meters was not very good. I tried 40 meters just before sunset but there is a major problem with intruders operating SSB in the band. The level of interference is incredible, particularly in the early evenings, and it was very difficult to find a clear frequency, let alone make any QSOs.

Kazu JA1RJU and 10 members of SARS joined us for dinner at the Kampung Nelayan Seafood Restaurant. Jan and Stella were called upon to choose the food from an extensive array of fresh, local vegetables, fish, and live crabs. Phil and I discussed the state of the bands, and he confirmed the lack of activity during daylight hours, recommending that I concentrate on 40 meters, as East Malaysia is apparently much in demand on that band. DX-EDGE indicated an opening into the eastern USA and a full darkness path to Europe, with dawn at about 2200 UTC (6 a.m.), when the intruders would (hopefully) still be in bed.

Jan and Stella went shopping the following morning, with the excuse that I could then play radio in peace for a couple of hours. This sounded like a good idea, but unfortunately activity died after about 9.30 a.m. The girls didn't get back until well after 2 p.m., by which time I had made only a few

Photo D. G3SWH relaxes between QSOs at the Tanjung Aru.

QSOs, including A45XR and EL2WW, so I was certainly getting out. Another late afternoon/early evening session added a few more QSOs to the log, but 40 meters was again hard going.

Dinner that evening was an informal affair with Godfrey and Stella at the KK Yacht Club, of which Godfrey is a former commodore. Kelly, their 19-year-old daughter, joined us. After dinner, I managed another short session on 40 meters around 10 p.m. and found the band much quieter, but we had to be up early.

Next day, we took the train from KK to Tenom, a small town in the interior. There are only 154 km of narrow gauge railway track in the whole of Sabah, connecting KK to Melalap. The best part of the journey was between Beaufort and Tenom, where the train was packed with locals and their produce. The track follows the course of the Sungai Padas through spectacular gorges and over rickety wooden bridges with excellent views of the jungle and muddy brown river.

At Tenom, Godfrey had arranged for us to be met by Alex Yong 9W6JP. Alex holds a Class B, 2-meters-only license, and runs a coffee roasting and packaging business in the town. He very kindly drove us to Hillview Gardens in Keningau, home of 9M6AAC, where we met the owners, Alfons 9M6MU and Doris 9M6DU. What a fabulous QTH! On top of a hill, with a clear take off in all directions and the nearest obstruction over 20 km away. Jani YB0US/NM6US/9M6US was in the process of putting the finishing touches to the new shack in anticipation of the arrival the following day of Bob N2OO and his gang for the start of their Borneo Expedition. Phil and Godfrey were waiting for us and, after lunch, drove us back to the hotel in KK, where we watched a most spectacular sunset before another short battle with the intruders on 40 meters.

The following morning, an early session on 40 meters included a QSO with G3VZT, my first G. Phil picked me up at 8 a.m. and took me to the Promenade Hotel in downtown KK for breakfast with Bob N2OO and Bill N2WB, who had arrived in the small hours. Jan had suffered a sleepless night, took the opportunity of a lie-on and didn't join us. Doris, Alfons and Jani were there also, ready to drive Bob and Bill back to Keningau.

Later, I took down the antenna and packed up the station, as we were leaving very early next morning for the next stage of our holiday. I made 412 CW QSOs from the Tanjung Aru Hotel, 224 of which were on 40 meters, in just over eight hours of operating between 4 and 7 November 1999.

At 5:30 a.m. on the 8th, we were at the airport boarding the commuter flight from KK to Sandakan on the east coast. We were met by our personal guide, Khui Lin, and dropped our nonessential baggage at the Renaissance Hotel before departing for an overnight stay at the Sukau River Lodge on the Sungai Kinabatangan. During the two-hour road journey, we stopped at the Gomantong Caves, which are Sabah's most famous source of the swiftlets' nests used for bird's-nest soup. The carefully constructed wooden walkway over the floor of the caves is so slippery with guano as to be treacherous, and you dare not put your hand on the safety rail for fear of gathering a handful of cockroaches. Not recommended for the faint-hearted!

A narrow corridor of rain forest exists along the banks of the Kinabatangan, and the area is rich with wildlife. Sukau is the main village on the lower section, a short distance past the caves. The lodge itself offers comfortable, mosquitoproof, en-suite rooms,

Photo E. The setup at the Renaissance Hotel in Sandakan was no different from elsewhere, albeit totally indoors.

good food, and a bar. We arrived in time for lunch, and afterwards took a short siesta.

In the late afternoon, Khui Lin took us for a cruise on a tributary of the river, where we saw snakes, monitor lizards, long-tailed and pig-tailed macaques, proboscis monkeys, and many species of birds. After dinner, we went for a trek in the jungle around the lodge, seeing various nocturnal creatures. Returning to the lodge, I noticed what looked like a striped snail on my ankle. To the delight of Khui Lin and the other guests, it proved to be a tiger leech feasting on my blood. After being photographed, the poor creature was dispatched with an application of salt, rather than the traditional cigarette end.

Early next morning, we took another river cruise, this time on the main stream. Here we saw three orangutan in the wild — quite a rare sight — a solitary crocodile, macaques, proboscis monkeys, and many birds, including the brilliantly colored stork-billed kingfisher. We landed to explore the oxbow lakes and, after the previous night's experience, put on leechproof socks made of calico, which is too dense for the leeches to penetrate.

After lunch, we returned to Sandakan for two nights at the Renaissance Hotel. Again, Godfrey had prepared the way, and we were allocated Room 713 on the seventh floor. The hotel manager requested a copy of my license but readily agreed to an "unobtrusive" antenna. Unfortunately, the room had no balcony, and Jan immediately had misgivings about me operating in the same room in which she was sleeping. Having suitably reassured her, I set about rigging the antenna, but it was clear that lowering and raising it to change bands would not be possible. I settled for a sloping dipole for 30 meters facing north, and hoped that it would tune for some of the other bands.

The next day, we took a taxi to the Sepilok Orangutan Rehabilitation Center, about 25 km outside town. Orphaned and injured orangutans are brought here from all over Sabah to be rehabilitated to return to forest life. They are free to forage in the surrounding

Photo F. Observant readers will note from this photo of G3SWH at the Rasa Ria that he has now gone "/V&T" (vodka and tonic portable).

forest but are fed twice daily at a platform about 10 minutes' walk from the center. We were lucky and saw nine, including a large male and three babies.

We took the local bus back toward Sandakan and stopped off at the Australian War Memorial. This is in a quiet wooded park on the site of a Japanese POW camp during WWII, and the starting point of the infamous "death marches" to Ranau, 250 km away through the jungle. Of some 2,400 Allied soldiers in the camp, only six Australians survived — and they were the ones who escaped. The camp commandant was later executed as a war criminal.

Next morning was our last in Sandakan, and we decided to explore the town. Nowadays, it is a thriving commercial center with a busy waterfront and market, where we were pursued by a group of small boys demanding money. Jan placated them with a tube of polos (candies with a hole in the center)!

We bought some amazingly cheap fabric and tee shirts and took a taxi back to the hotel. There was then just time for a last session on the air before the short flight back to KK. I made 243 CW QSOs from the Renaissance Hotel, 183 of which were on 30 meters, in just over four hours of operating between 9 and 11 November 1999.

Transport was waiting at KK airport and we were driven to the Shangri-La Rasa Ria Hotel at Dalit Bay, about an hour north of the city. We checked into Room 632, once again on the top floor, facing west.

Next morning, I contacted the hotel's engineering manager, who had been informed by the Tanjung Aru of my impending arrival. Again, there were no problems in putting up my antenna. A sloping 40-meter dipole was erected, running east/west between the balcony and a convenient palm tree, with the station on the balcony overlooking the sea.

An early evening session provided a nice run on 40 meters, in spite of the intruders, until Godfrey, Stella, Kelly, and Phil joined us for drinks in our room and a buffet dinner in the hotel restaurant. I resolved to be up early the following morning to work 40 meters. The first QSO was at 2115 UTC and I made 62 QSOs in the hour or so before the band died only 10 minutes after sunrise.

After breakfast, we hired a car with a driver to visit the Mount Kinabalu National Park and the Poring Hot Springs, some 88 km from KK. The springs were developed by the Japanese during WWII and are popular with the local people.

On Sunday the 14th, we hired the same car and driver to take us to the weekly tamu at Kota Balud, a small

Photo G. Dinner at the Rasa Ria: XYL Jan and Phil G3SWH; Stella 9M6JY, Godfrey 9M6GY, and daughter Kelly.

town about an hour's drive north of the hotel. Tamus are open-air markets where villagers gather to sell their farm produce and to buy manufactured goods from traders. We arrived midmorning and found it to be a colorful melee of locals buying and selling live chickens and rabbits; fish, meat, and vegetables; cooked food; and fabric. There were literally thousands of people, including fewer than a dozen Europeans.

On the way back to the hotel, we stopped at the Mengkabong water village, which is a traditional stilt village built over the mud of the estuary. Most of the simple houses have electricity and telephone; all have fresh water, and many modern cars are parked on the shore, but sanitation is nonexistent. Dogs romp in the mud at low tide and children swim in the river, apparently immune to disease.

That evening, whilst I was working on 17 meters, we received a visit from Will, the tame wreathed hornbill from the hotel's wildlife reserve, who landed on the balcony rail in front of Jan. He then proceeded to devour our bowl of nuts, before flapping off to terrorize some other unsuspecting hotel visitors.

I followed the same formula for our last morning, getting up at about 5 a.m. to work 40 meters, and managed to work a few more Europeans. It was then time to take down the antenna and dismantle the station. I made 506 QSOs from the Rasa Ria Hotel, 375 of which were on 40 meters, in just over ten hours of operating between 12 and 14 November 1999.

I shall have to rethink my antenna setup for future operations, as the limitations of being unable to change band quickly severely hampered me and certainly reduced the overall QSO total, I am quite sure.

Special QSL cards have been printed and are available either from my *Callbook* address with SAE and return postage or via the RSGB bureau.

My particular thanks go to my XYL, Jan; Godfrey 9M6GY; Phil 9M6CT; and the management teams of the three hotels, without whose help and cooperation this DXpedition would not have been possible.

Photo H. *Will, the Rasa Ria's tame wreathed hornbill, was quite an "operator" himself.*

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Arachnida Warcum

Whatever you call it,
this WARC bands spider species is a triband delta loop well worth trying.

With apologies to Mr. A. King, my Latin instructor, for the title, let me point out at the outset that this will be a description of an HF antenna, not a technical treatment of why it works the way it does. But this antenna does work, and it works well.

There are three laws that apply to home-brewing a wire antenna. One, real estate. The space needed for the antenna is always smaller than the size of the antenna. Two, the cost of the antenna will be inversely proportional to the size of the builder's wallet. Third, the efficiency of the antenna is directly proportional to the size of the antenna.

With these problems facing the fledgling "Marconi," it could give pause at the start of this project.

Take heart. The following description, complete with dimensions, will suit the average wallet and will fit in the average yard. It also has a slight gain over a dipole, and it seems to be quieter than most antennas. What more could any ham want?

With propagation as good as it has been, this project should be up and running ASAP. According to the DX pundits, these conditions should be around for a while.

The antenna is a triband delta loop. The bands concerned here are the so-called WARC bands, but any number or coverage can be built to your specs. What this article will give you are the dimensions, and how I hung the loops with minimum interaction.

Basically, the antenna is three triangles mounted concentrically [**Fig. 1(b)**]. I used #18 stranded in green. This wire was chosen for strength vs. weight. Actually, I had a supply of this wire from a wise buy at a flea market. Any color or weight will do.

The wire was pre-stretched by looping each element around a tree or post and temporarily tying a square (reef) knot at the free ends around my waist. Then you really lean back against the wire. This stops the element from changing dimensions after it is hung.

The loops are hung one inside the other, with the 30m loop being hung as

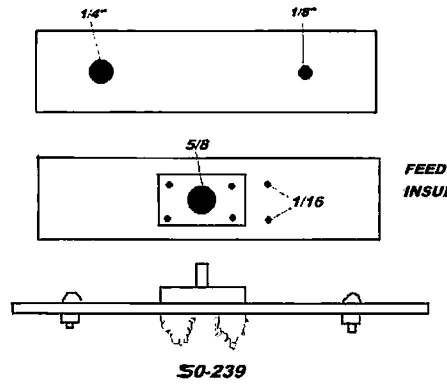

Fig. 1(a). Feedpoint insulator.

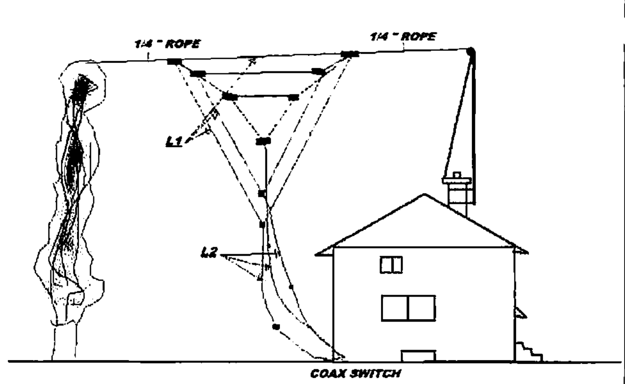

Fig 1(b). Overall hanging method.

TABLE 1			
BAND	TOTAL L1	1/4-MATCHING SECTION	CENTRE FREQ.
30 MTRS	100.35 FT.	16 FT.	10.125 MHz
18 MTRS	56.0 FT.	8.96 FT.	18.125 MHz
12 MTRS	40.7 FT.	6.5 FT.	24.925 MHz
FORMULA L1= 1016x.VF / FREQ ; MHz		FORMULA FOR MATCHING xFMR 246 x.VF / FREQ. (IN MHz)	

Table 1. Element lengths.

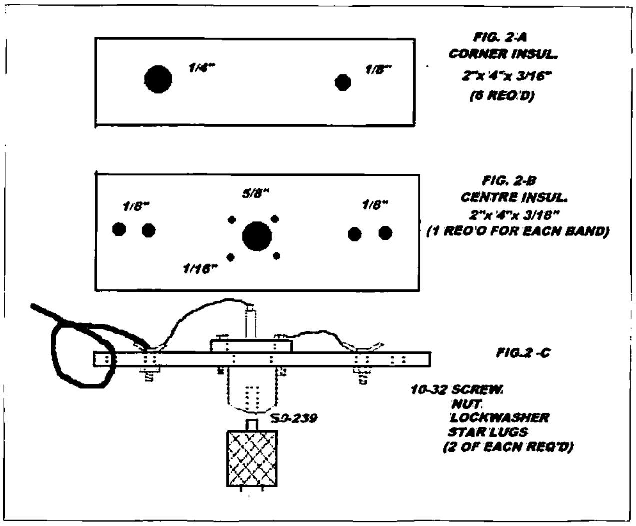

***Fig. 2.** (a) Corner insulator, 2" x 4" x 3/16" (6 required). **(b)** Center insulator, 2" x 4" x 3/16" (1 required for each band). **(c)** 10-32 screw, nut, lock washer, star lugs (2 of each required).*

the main support. The 30m loop is supported by 3/16" marine halyard, which is weather- and UV-impervious, and has a breaking strength of over a thousand pounds. It will not stretch. I use pulleys at the end of the supports so it is easy to adjust the loops just by lowering each end. Then I do the pruning from the ground.

The coax used is RG-58U and RG-59U, to keep the weight to a minimum.

The feedpoint impedance of a delta loop is theoretically 125 ohms. I used a quarter-wave section of RG-59U as an inline impedance transformer, which makes the feedpoint approximately 100 ohms.

Now, don't panic. I said that there would be no technical stuff. So, with that out of the way, we can refer to **Table 1**. Now we assemble our coax 1/4-wave using the RG-9U. A little tip: When using UHF-type connectors, measure from the connector face, not the end of the center pin.

At this point, here is a list of hardware needed:

- 1 large roll of "Coax-Seal" or 1 roll of 3M #33 vinyl tape;
- 9 PL-259 UHF connectors;
- 6 UG-175 adapters;
- 3 UG-176 adapters;
- Enough RG-58U coax to make feedlines from the end of the 1/4-wave transformers to the first available site for a coax switch;
- Enough RG-59U to make the matching sections. Obtain some 3/16" or 1/4" scrap Plexiglas to make the required insulators. A source for this is your local auto glass repair depot. If that doesn't pan out, you can buy 5/8" to 3/4" hardwood dowels, and a pint of outdoor varnish.

In reference to the materials list, you don't have to have both the vinyl tape and sealant. They are used in weatherproofing the feedpoint connection. I have done it both ways. The sealant is easier to use, but I have used the tape method and after more than two years the join was clean and shiny. It takes a little more patience but it will do the job.

Now we're ready to start construction. Measure the element length (after pre-stretching) from **Table 1**. Now cut the coax to length. After you assemble the UHF connector, you'll be an expert at installing coax connectors.

When measuring finished coax cable you measure from the plug face to plug face, *not* the end of the center pin.

Remember, if you want to put up a good antenna (and who doesn't), follow the formulas or recut lengths exactly. I know they appear long according to a lot of antenna books, perhaps because they are close to the ground or to my two-story aluminum siding.

When hanging the loops, I made the horizontal section approximately 10% to 15% longer than the sides of the loop, to help raise the feedpoint above the ground.

The next step is to cut and drill the insulators as in **Fig. 1(a).** As illustrated, the element wire passes through the 1/8" hole, once over the end, and through the 1/8" hole again. This will stop the insulator from moving from its position.

At the feedpoint insulator, the wire goes through the hole twice and is then soldered as required.

For those who are purists, the SWR may not show unity. But with my installation, the SWR was never worse than 1.9:1 at the band edges.

If your rig's output circuit has trouble dealing with the SWR, use a tuner. Or, if you can source some 90–100 ohm coax, that would make the match right on the money. As previously stated, perfection in this project is not a requirement.

For those who are interested, the results were very satisfying. The first ten days produced 44 countries. After five weeks, I had logged 81 countries. In a little over a month, I logged more than I had in the previous year and a half.

The rig I use is a Kenwood TS-430S, which I run very lightly — about 60W–70W.

The antenna was installed with north/south orientation. The pattern should favor east-west, but I made a number of contacts off the ends. There appears to be no null or, at best (or worst), very narrow.

So, there you have it. A cheap and dirty antenna to work the world. This antenna worked almost enough stations to get my DXCC.

Continued on page 57

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Way Cool Rocket Project — Conclusion

This 70cm rocketborne radio telemetry system is strictly for kids — NOT!

So far in this series of articles, you have learned how to build the telemetry transmitter, receiver, and telemetry-tracking antenna, and you have learned how to modify the rocket airframe to house the telemetry electronics. In this last in the series of articles, you will learn about calibration of the temperature sensor, launch operations, telemetry data recovery, and data analysis.

A sensor calibration table must be created in order to effectively analyze the received telemetry data. In the case of our Sounding Rocket 101 system, the telemetry data is composed of variable width audio tone pulses. The width of the audio tone pulse is directly proportional to temperature. In order to generate a calibration table, the payload section of the rocket, along with the sensor, must be subjected to a range of known hot and cold temperatures, and a record made of the sensor/transmitter signal in response to varying temperature. The easiest way to accomplish this is to build a small, insulated calibration chamber that will house the rocket payload. I used a small Styrofoam ice chest as the calibration chamber. See **Photo A.**

The chamber is fitted with a 40-watt ceiling fan light bulb as a heat source, and a small fan to move air within the chamber to prevent stratification of temperature within the chamber. Both the fan and light bulb are powered by 115 VAC and are placed on separate switches. **Fig. 1** is a schematic of the heat source and fan for the calibration chamber.

To build the calibration chamber, first mount the light bulb, fan, and switch box to the cover of the Styrofoam ice chest. I used a Leviton Model 632-8829-CW4 keyless plastic lampholder. This was fastened to the inside of the ice chest with 6-32 x 4-inch hardware. Make sure to use washers on the Styrofoam side to prevent the nut from deforming the soft Styrofoam. The fan I used was purchased at

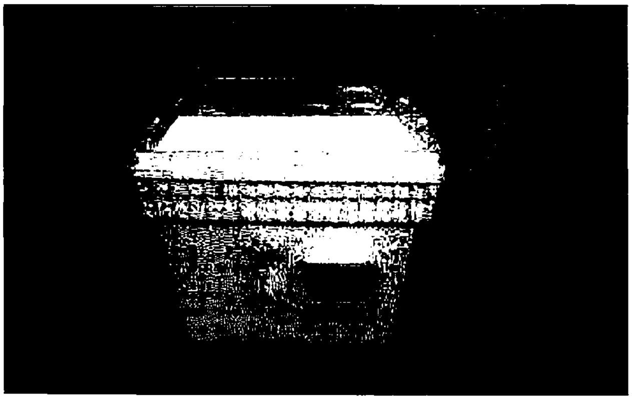

Photo A. *The completed Sounding Rocket 101 temperature calibration chamber, showing the thermometer readout in place on the mounting bracket.*

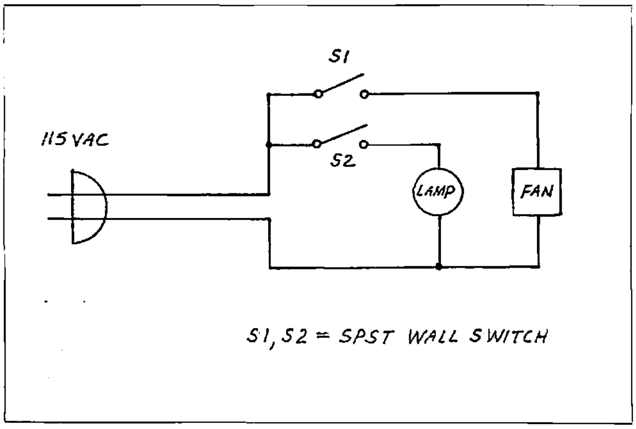

Fig. 1. *Schematic of the heat source and fan for the calibration chamber.*

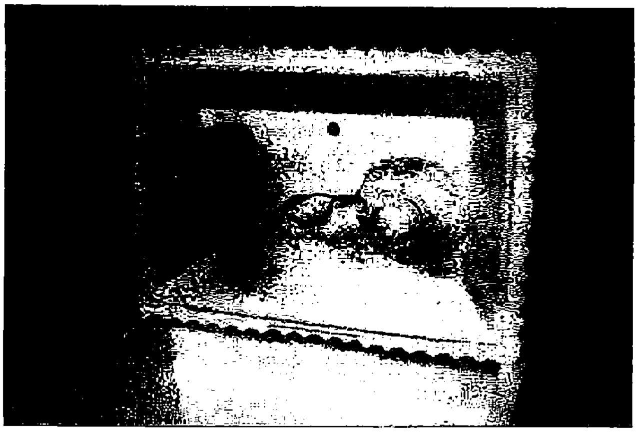

Photo B. *Light bulb and fan mounted to the inside of the ice chest lid.*

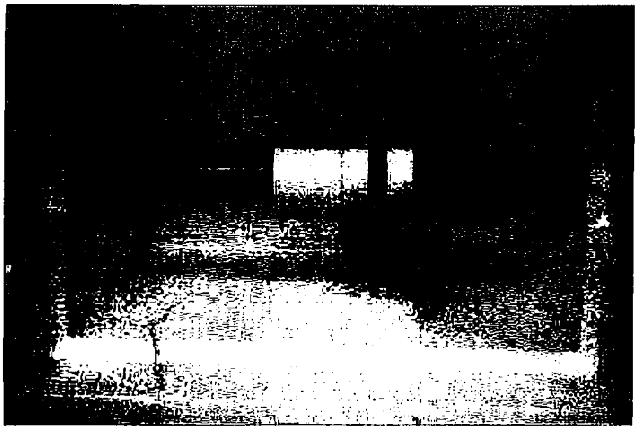

Photo C. *The payload section of the rocket in place within the chamber.*

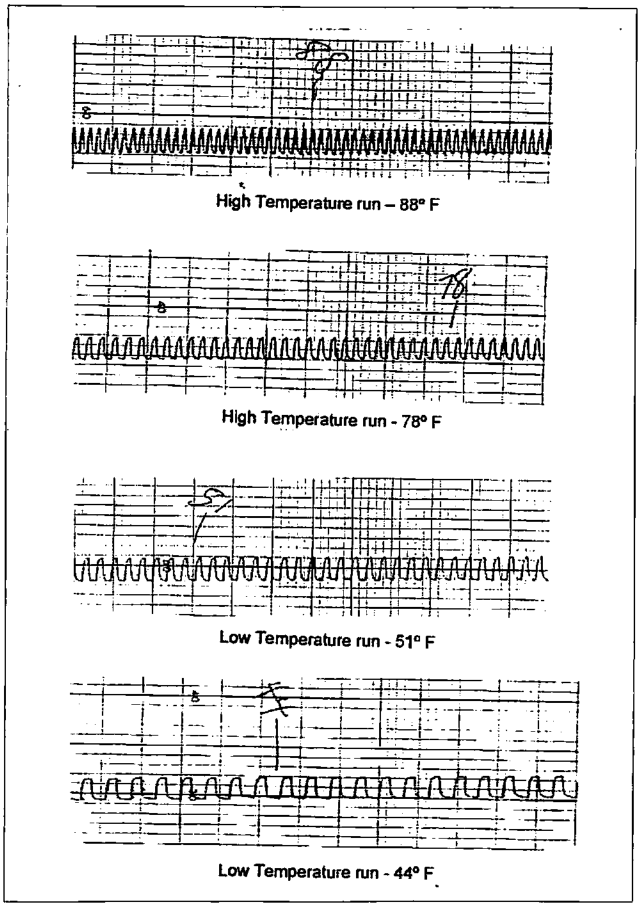

Fig. 2. *Sample strip chart output from both the high and low temperature calibration runs. The strip chart recorder used with this project was a Perkin-Elmer R50 single channel servo-type recorder.*

a flea market and was fitted with two mounting holes tapped for 6-32 hardware. Depending on the fan you use, you may need to suspend the fan from the inside of the ice chest lid with metal or plastic straps as in **Photo B**.

Measure halfway down on the side of the Styrofoam ice chest and make a mark. Center the end of the rocket airframe on the mark and carefully draw around the end of the airframe. Use a sharp hobby knife to cut out a circle just inside the circular mark delineating the end of the airframe. Next, slide the rear portion of the payload section of the rocket into the circular opening you just cut out. It should be a bit of a tight fit. Position the payload section in the chamber so that it is parallel with the bottom of the chamber. If your chamber is small enough, you can support the front, or nose cone end, by pushing it into the Styrofoam slightly to form a small divot. This will adequately support the forward portion of the payload section. If you are using a larger chamber, you will need to install a support for the front portion of the payload. **Photo C** shows the payload section of the rocket in place within the chamber.

Temperature measurement is accomplished with a Chaney Instrument Acu-Rite Model 00884 digital LCD display indoor/outdoor thermometer. The outdoor sensor is mounted to the inside wall of the calibration chamber. The unit I used is supplied with a small mounting bracket that is attached to the front of the chamber. The thermometer readout is then attached to the bracket (**Photo A**).

To operate the calibration chamber, the payload section is placed in the chamber with the transmitter-enabling plug removed. This will activate the transmitter. The chamber lid is put in place and the receiver, decoder, and strip chart recorder are placed a few feet away from the chamber. Power is applied to the digital thermometer. Next, the fan switch is turned on, followed by the lamp switch. Ensure that the strip chart recorder is displaying the received telemetry signal on the paper. Carefully note the digital temperature display. For each two-degree rise in temperature, make a note of the temperature on the strip chart record. Continue this process until you have recorded the telemetry signal through a temperature of 100 degrees F. Turn off the strip chart recorder, receiver, fan, and lamp. Open the chamber to reinstall the transmitter-enabling plug. This will turn off the transmitter. Allow the entire calibration chamber to cool back to room temperature. Fill the bottom of the calibration chamber with 2 inches of ice. Turn on the receiver and strip chart recorder. Apply power to the digital thermometer. Pull the

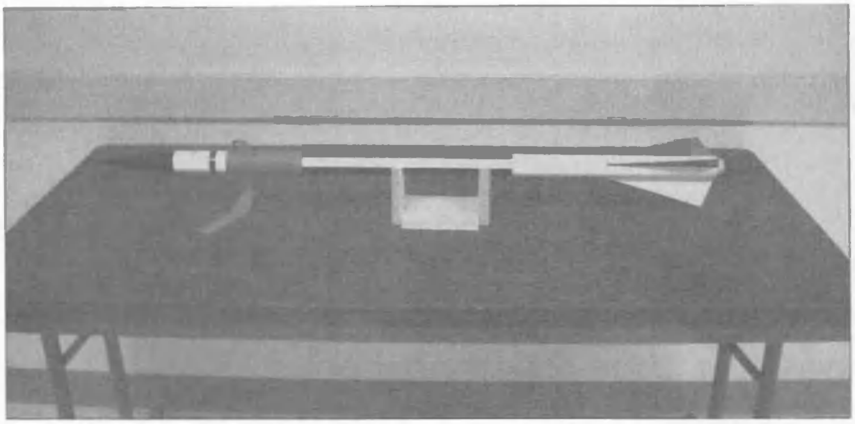

Photo D. Ready for launch.

transmitter-enabling plug to apply power to the telemetry transmitter. Place the lid on the chamber and turn on the fan. Do not turn on the lamp. As you did with the high temperature run, make a note of the temperature on the strip chart record for every two-degree temperature change. Continue the low temperature calibration run until chamber temperature reaches 32 degrees F. **Fig. 2** shows sample strip chart output from both the high temperature and low temperature calibration runs. The strip chart recorder used with this project was a Perkin-Elmer R50 single channel servo-type recorder.

A useful tool to assist in reduction of flight telemetry data is a transparent plastic scale calibrated into pulsewidth vs. temperature values. This tool is of particular value if you will be working with schoolchildren with this telemetry project. Children can become frustrated very quickly trying to accurately measure each pulse record on the strip chart. By using the gauge, they can more quickly measure the telemetry temperature values. Now that the telemetry sensor is calibrated, it is time to fly the bird and gather data.

Photo E. The rocket at liftoff.

Flight operations

To enhance optical tracking of the rocket, I recommend painting the rocket in a high-visibility color scheme. **Photo C** shows one possible paint scheme. Black and white patterns with fluorescent orange were selected as experience has demonstrated this combination to yield high visibility at altitude.

This is an important step, as under power of the recommended Aerotech G35-7W rocket motor, the rocket will reach an altitude of over 2,000 feet. Beyond about 1,000 feet, the rocket will disappear. You want a high-visibility color scheme to allow for optical re-acquisition as the rocket descends under its recovery parachute. The change in physical geometry at apogee when the parachute is ejected will usually catch the eye. In descent mode, the rocket is a much larger object and is easier to optically track if it appears in eye-catching colors.

Of equal or greater importance is installation of fresh batteries in all the project electronics. In the transmitter, make sure to secure the 9-volt battery to the transmitter circuit board with a

Photo F. The powered ascent.

length of wire or string along the long axis of the battery, and with a length of electrical tape about the short axis of the battery. Once all the batteries are in, it is always a good idea to ground check all the electronics before leaving for the launch site. Make sure that the transmitter-enabling plug is in place on the rocket payload section. This plug will be removed just before launch to turn on the telemetry transmitter. If you will be videotaping the launch, make sure the camera battery

Photo G. Author N4XVF operating the telemetry tracking station.

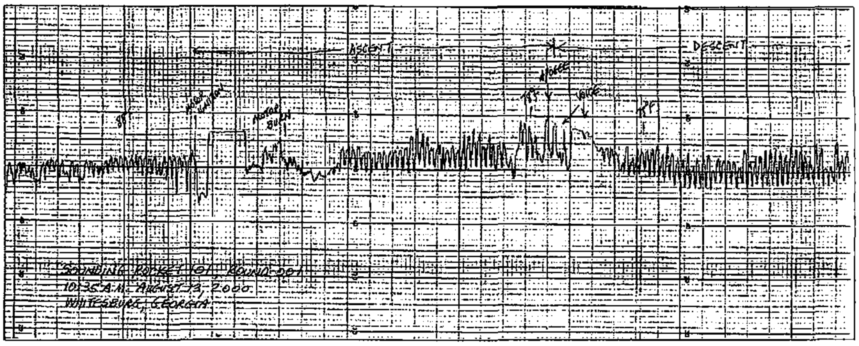

Fig. 3. A portion of the telemetry record from launch to apogee and the beginning of the descent phase.

is fully charged the night before the launch.

This project is a complex one and should not be attempted alone. If you need to, contact the National Association of Rocketry for the location of local rocketry clubs. I have always found rocketry hobbyists to be eager to help, particularly with an interesting project such as this one. I recommend the following minimum launch crew complement:

• Two optical trackers. These crew members will follow the ascent of the rocket to apogee and record the angle of the rocket with the horizon. These recorded angles are used with simple trigonometry to determine the altitude of the rocket. This is an important measurement, as the telemetry data is of little use if you don't know where it was measured.

• One videotape cameraman. I have found it very useful, particularly with middle school–age children, to integrate the videotape with the strip chart record. This drives home the idea of where the data was measured. This crew member will videotape the entire flight from launch to touchdown.

• Telemetry Tracking Station Operator. This launch crewman operates the telemetry receiver and recorder and steers the tracking antenna to follow the rocket in flight.

• Recovery Crew. It is the responsibility of these crewmen to retrieve the rocket and reinstall the enabling plug in the transmitter payload to turn off the transmitter.

• Launch Control Officer and Range Safety Officer. These personnel are adult members who are experienced rocket hobbyists. They are responsible for range safety and electrical ignition of the rocket motor.

Sounding Rocket 101, Round 001, described in this series of articles, had

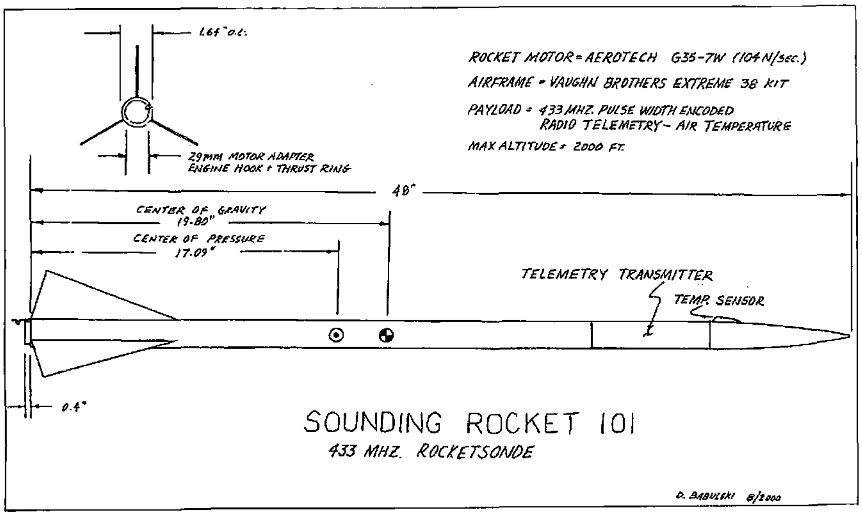

Fig. 4. Basic engineering data for Sounding Rocket 101, Round 001.

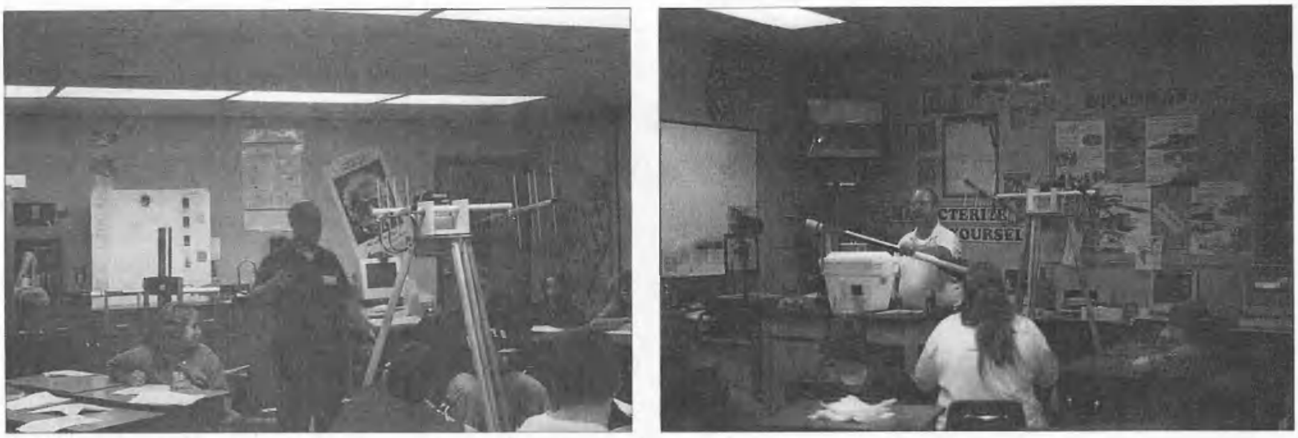

Photo H. Not afraid to preach what he practices, N4XVF is a much appreciated classroom crusader.

its initial flight on August 13, 2000, from a three-rail launch tower of my own design at pad 24 on the Southern Area Association of Rocketry range located near Whitesburg GA. The telemetry transmitter was enabled at 10:30 a.m., with rocket motor ignition occurring at 10:35 a.m. The rocket reached an altitude of 2,200 feet. The 433 MHz telemetry system performed perfectly, with solid received signal during the entire flight profile. Total flight time from launch to touchdown lasted two minutes. See **Photos E** and **F**.

Careful examination of **Photo G** shows the addition of a Ten-Tec audio amplifier and an additional shelf to hold the audio tape recorder. The Ten-Tec amplifier was used to boost audio output of the receiver to more effectively couple to the audio recorder. For this flight I elected to run the audio recorder in loose-coupled mode to capture sounds from the range as well as the telemetry data signal.

Photo I. N4XVF's 12-page classroom handout features this logo on the cover.

Once the telemetry data is recorded on audiotape, the next step is to run the audio signal through the frequency-to-voltage converter and print out the data on a strip chart recorder. Once the data is printed out, measurements can then be made to determine the recorded temperature.

Surface weather conditions at the time of launch were clear sky, sunny, with wind at 4 mph from the southeast. Data from the flight of Sounding Rocket 101, Round 001 showed ground level air temperature to be 88 degrees F, with an air temperature of 78 degrees F at 2,200 feet. This measurement is very close to the predicted dry adiabatic lapse rate of 5.4 degrees F temperature decrease per 1,000 feet. **Fig. 3** is the portion of the telemetry record from launch to apogee and the beginning of the descent phase. (The chart record for the entire flight is about four feet long, much too large to include in this article!)

Some may question why digital techniques were not used to record the temperature data. The answer here is the additional educational value of requiring the student to measure, plot, and graph the temperature data points. It could be argued that it would be easier to record temperature measurements directly to onboard RAM and read it via software directly to a screen graph. However, much more knowledge and skill are learned by reducing the recorded telemetry data the long way. A challenge to more advanced students is to write a software program that would use the recorded audio pulse width telemetry data to generate a temperature vs. altitude graph on the computer screen. For those readers who may wish to duplicate this project, please refer to **Fig. 4**.

I am developing a small curriculum package directed at 6th- 7th-, and 8th-grade Farth Science students as a companion to the Sounding Rocket 101 project. This curriculum package will be used with a volunteer Sounding Rocket 101 program and middle school Earth Science students in Georgia. Those readers who are interested in this curriculum package or the Sounding Rocket 101 project are encouraged to contact me via E-mail at [dbabulsk @lanier.com], or via snail-mail.

Continued on page 57

Qty.	Description
1	Styrofoam ice chest with dimensions 12 x 8 x 15 inches or similar
1	Dual switchbox with dual switch cover plate
2	SPST wall switches
1	115 VAC muffin-type fan
1	AC power cord
1	Chaney Instrument Acu-Rite Model 00884 LCD display indoor/outdoor thermometer (found at garden stores or variety centers)
1	40 W ceiling fan light bulb (Phillips #BC40A15/FAN)
1	Leviton Model 632-8829-CW4 keyless lampholder
As required	#12 solid copper insulated wire

Table 1. Parts list for the calibration chamber.

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Disaster Overkill

Say what you want about this ham's response to emergency preparedness — until you need him, that is.

Disaster communications — I'm sure this is a subject every ham gives at least some thought to from time to time. The real question is how prepared are you — right now or on very short notice — to provide emergency communications? You should be able to go beyond a handheld 2m FM rig and some spare batteries. And most of us cannot afford or have no need for a military surplus 6X6 with an equipment shelter on the back. This article looks at how one ham — Thomas G. Eggers N3JNJ — is set to go, and what he has done to provide emergency communications literally at the drop of a hat. In addition, he has done this on a reasonable budget, one that you might do well to emulate.

First, let me make a confession. Here in Alaska, if you have an HF rig mounted in your car, the state will waive the registration fee (some restrictions apply). Even with this incentive, I do not have my 4x4 rigged to carry a radio. I do have battery boxes, solar panels, and a GRC-9 and GRC-47 in their transit cases and ready to go — and even take them out to use at Field Day and our club BBQ. Available? Yes. Ready? No. Since I don't own a travel trailer or motorhome, what Tom has done makes sense for me and, I suspect, a lot of other hams.

Just what is it that Tom can do that is so impressive?

Well, he can back up his Jeep and latch onto an impressive array of equipment and camping gear — always ready to go. Tom is retired from the Air Force, and while on active duty, spent many years as a professional radio maintenance technician in the field. He understands first-hand the problems that crop up when you are out of the shack and working high volume traffic. He has taken an inexpensive trailer kit and built an impressive communications center. It is worth some time to exam closely *what* he has done and the *why* behind it.

To begin with and provide a basis for comparison, we can define the problem(s) of field communications support as ones of transportation, setup/operation, and field logistics support. Each of these areas must be addressed for the amateur or professional operator to be successful in providing critical communications to emergency services crews.

The problem of transporting equipment can be further defined as transportation, protection, and use once you

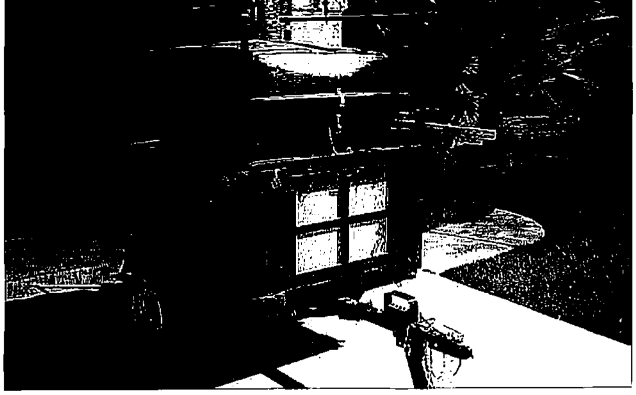

Photo A. *Communications center trailer, starboard side.*

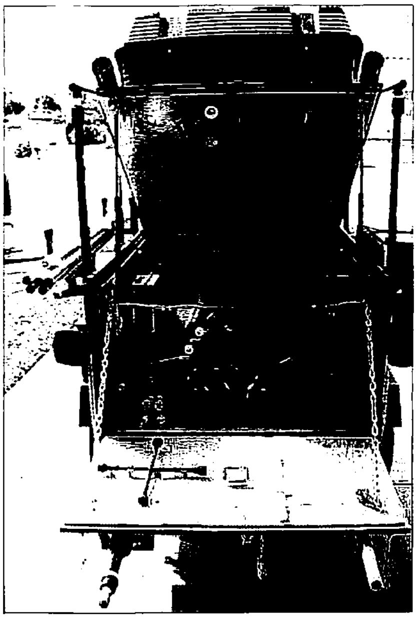

Photo B. *Rear of system, open. Note storage of fuel, antennas on top, and tailgate as work area.*

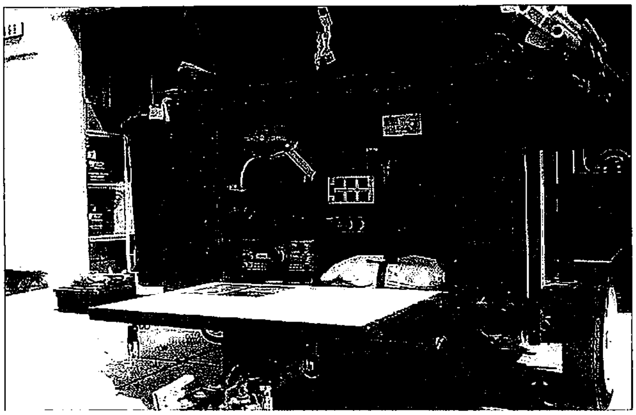

Photo C. *Front of system, open, showing installed equipment and operator table.*

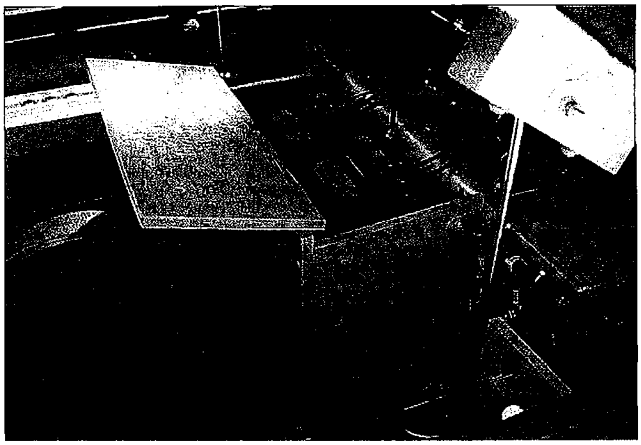

Photo D. *Interior shot showing battery and power filters.*

have arrived at your communications point. In the transport phase, you must provide protection for your equipment from the elements, mechanical (vibration) damage, and temperature/dust/humidity. In my case, the use of mil-spec radios and transit cases provides what could be considered excessive protection — after all, I doubt I'll be jumping out of perfectly good airplanes again any time soon. On the other hand, the transit cases do allow me to put the equipment into my open utility trailer, next to the genset, and take off.

In Tom's example, he has, I believe, reached a very good compromise. If you look at the trailer in **Photo A**, you see that the front appears solid. This front piece, in fact, folds

N3JNJ
Communications Trailer
Equipment Listing/Inventory:
Radio/Computer

Radio Equipment
Transceiver, UHF/440 MHz (Yaesu FT-712RH)
Transceiver, VHF/2m (GE MV5)
Transceiver, HF/2–30 MHz (Kenwood TS –130S)
Transceiver, CB/11m (Midland Model 77-112)

Associated Radio Equipment
HF ThruLine Watt/SWR Meter (Dentron SWR-1A)
HF Antenna Tuner/Matcher (Kenwood AT-130)
HF Antenna Tuner/Matcher (Dentron Jr.)
HF Band Pass Filter
In-line Lightning Arrestor
CB/11m Antenna Tuner/Matcher (Home Brew)
VHF/2m ThruLine Watt/SWR Meter (MFJ Model MFJ-812B)
External PA Speaker with Mag Mount and 30 feet of cable
External Speaker HF
External Speaker VHF
External Speaker UHF
External Speaker CB

Optional Equipment
Laptop Computer, Toshiba Model T1100 Plus
Packet Pallet (Lazy-Susan type) set up for use with HT/Hand-Held Radio (includes: All-Mode Kamtronics Kam/TNC, 35 Watt RF Amp, Power Distribution Box, and Audio Output Adapter Box)

N3JNJ
Communications Trailer
Equipment Listing/Inventory:
Antennas

Antenna Mounts
1 ea. VHF Sectional Mast (Military GRA-4 type)(bolted to left front side of trailer)
1 ea. Aux Mount (Military GRA-4 type)(bolted to the right front of trailer)
1 ea. UHF Sectional Mast (Military GRA-4 type)(bolted to the right side of the trailer tailgate)
1 ea. HF (Military NVIS type) Base Mount (bolted to the left side of the trailer tailgate)
1 ea. HF Ball Mount (bolted to the left side rear of the trailer)
1 ea. CB Ball Mount (bolted to the right side rear of the trailer)

Antennas
440 MHz, 1/2-Wave Vertical (Base Loaded)
VHF/2m Full Wave Vertical (Center-Loaded with Ground Plane Elements)
VHF/2m 3-Element Beam
VHF/2m 5/8-Wave Vertical (Base-Loaded with Mag Mount)
CB/11m Fiberglass Vertical (72-inch/6-foot, Top-Loaded)
HF/NVIS, Dual Inverted-V Dipole
HF/V-type (Hustler Stingers and Extension Rods)
HF/Telescoping Vertical (168-inch/14-foot)
HF/Screw together Vertical (231-inch/19-1/4-foot)(Mounts to top of military GRA-4 type Driven Mast)
HF/Horizontal Dipole (Hustler Stingers and Extension Rods)(Mounts to top of Military NVIS Mast)
Spare HF Mast Sections (12 ea. of Military GRA-4 type)

Photo E. Genset and DC cable set for battery recharge.

down and reveals several mounted radios, a laptop, TNC, and (a nice touch) a reading lamp. It seals against the rest of the trailer assembly and provides protection from the elements during the ride to the site. Once at the site, the "door" is opened and becomes an operating table. The equipment mounts are "soft," so road vibration is minimal, and the rigs are all mobile gear and

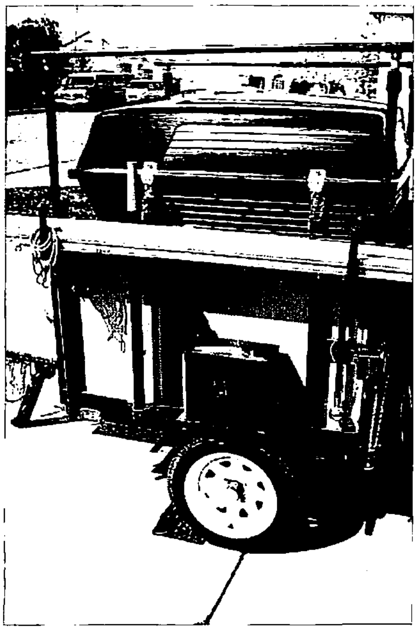

Photo F. All tenting stowed and ready to travel.

thus designed to handle what little does get through.

Setup and operation of equipment must be, as much as possible, defined in advance. Working in the rain, for example, is no fun, and trying to use non-mil-spec equipment in the rain would be a disaster of its own. Tom has designed his trailer to take advantage of his Jeep's tailgate setup. He can open the back hatch, which then extends over the operating table — a neat layout. If the weather gets really nasty, he has a tent that can be attached.

Examine the trailer in **Photo G**. The support structure allows tenting material to attach to the trailer and extends to one side. This will allow you to operate and cook/snooze or hang out — in the shade or out of the rain. The tent is stored in the interior of the trailer while in transit. This setup allows

Continued on page 26

N3JNJ
Communications Trailer
Equipment Listing/Inventory:
Power/Test/Camping

Power Equipment
12 VDC Marine, Deep Cycle, 90 Amp-Hour Battery (includes: 2 in-line power filters/capacitors and dual cutoff switches)
12 VDC to 110 VAC Power Converter, 3500 Watt (includes: 6-outlet power strip located in the radio compartment)
110 VAC battery charger (backup to generator when 110 VAC is available)
Generator, AC / DC, 350 Watt, 2 Cycle (Chicago #35286)(includes: 50-foot AC Output Cord, 50-foot DC Output Cord, Canvas Cover, Output Volt/Amp Meters, Spare Parts, Hand Tools, Protection Cage/Home Brew PVC)

Test Equipment
AC/DC Multimeter with assorted leads
Bird ThruLine Wattmeter with assorted elements, cables, and adapters

Camping Equipment
1 ea. Tent (with 10-by-10-foot groundcloth)
2 ea. Sleeping Bags
1 ea. Full-Size Air Mattress
1 ea. 12 VDC Air Pump
1 ea. Air Pump (foot-operated)
1 ea. Camp Stove (2-burner, white gas)
1 ea. Camp Lantern (2-mantel type, white gas)
1 ea. Wash Pan (for cleaning up)
1 ea. Plastic Container with Cooking Utensils (Frying Pan, Pot, Knives, Forks, Spoons, Spatula, Salt/Pepper, Lighter for stove and lantern, Paper Plates, Dishwashing liquid, Paper Towels, 1 Roll Toilet Paper)
1 ea. Portable Table (with adjustable leg length)
1 ea. Folding Chair
1 ea. Propane Heater

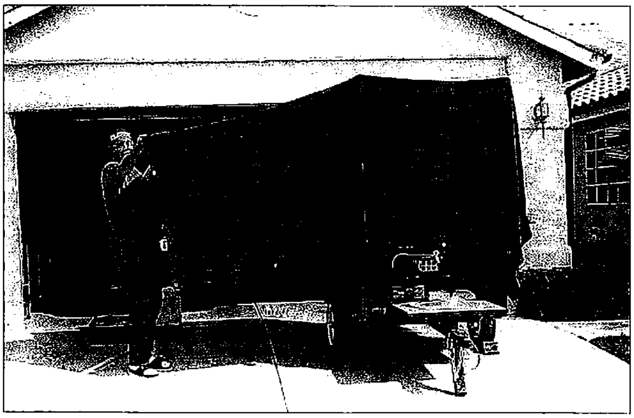

Photo G. *Tom is holding out the tent (normally this is guyed off to a set of stakes). You can see how much cover this will provide in the field.*

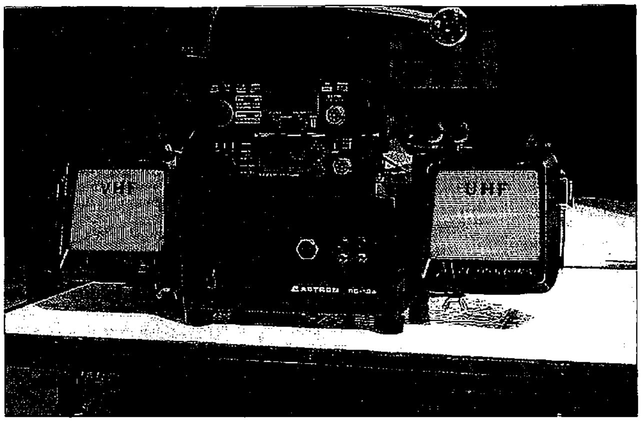

Photo H. *Flyaway rig, with wing speakers, power supply, and diplexer. It's all here and ready to go!*

Disaster Overkill

continued from page 25

maximum flexibility for field setup based on the specifics of the site.

Setup and operation of the communications center is very clever in both its simplicity and ease of use. You can literally pull up, park, set up a mobile antenna, and start to operate! The radios are mounted and covered in transit. Once on site, the operating "desk" is lowered and the battery switch is thrown to ON. Tom has mounted a battery and permanently wired in all of the radios and computer equipment. The antennas are fed back out to a set of bulkhead connectors which allow the use of either mobile type antennas or full-size, high-gain antennas. He has HF antennas from Hustler and a NVIS ground mount system, plus VHF and UHF antennas which will work off the trailer or Jeep.

Power to the battery is supplied by a small DC-only genset. This allows operation of the radios without a generator yammering away day and night. The generator is sized so that 90%+ of the DC goes to recharge the battery bank. Tom has modified the generator with a cage, set of meters, and a cover for protection when not in use. I suggested he consider adding a couple of solar panels. In southern Nevada

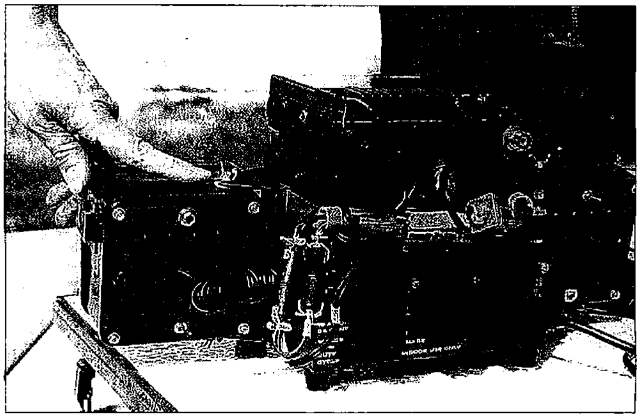

Photo I. *Detail of wing speaker — wing nuts mean no special tools are needed.*

N3JNJ
Communications Trailer
Equipment Listing/Inventory:
Miscellaneous

Misc. Items
Ground Rod for Central Ground (with insulated wire)
Lug Wrench (for wheel lug nuts)
Bottle Jack (for jacking up trailer to change wheels/flat tire)
Spare Tire (mounted to the trailer tailgate, includes cover)
Spare Hardware, Fuses, Lamps, Wire, and Connectors (stored in ammo can mounted to left side of trailer)
12-by-12-foot Canvas Tarp (includes support poles and guy ropes/stakes)(for covering trailer and equipment during operation)
12 VDC Goose Neck Lamp (installed in radio compartment, used during operation)
Fuel Can for Generator (2-Cycle Mix)(2 Gal.)
Fuel Can for Stove and Lamp (White Gas)(2 Gal.)
Jerry Can (Water)(6 Gal.)
Distilled Water Bottle (for battery)(1 Gal.)
6 ea. Spare Propane Bottles
Misc. RF Cables, Guy Ropes, Guy Rings, Stakes
Small Sledgehammer

Misc. Installed Items
3 ea. Antenna Bulkhead Feedthrough Connectors (S0-238 Type)(1 for VHF, 1 for UHF, 1 for HF)
2 ea. DC Power Bulkhead Feedthrough Connectors (Female Banana Type)(1 Red and 1 Black)
1 ea. Counter Poise Bulkhead Feedthrough Connector (Female Banana Type)(1 Black)(installed below HF Ball Mount on left rear of trailer)
1 ea. Ground Lug Connector (used to connect central ground)(installed on the front left corner of the trailer)
1 ea. Backup Light (installed center rear, below the tailgate)(used for the times when you have to back the trailer at night. The vehicle backup lights are usually blocked and are not of much use)
1 ea. DC Power strip (4-output)
1 ea. HT mount (mounted to front right side of trailer)
1 ea. Battery Pack Hanger (mounted to front right side of trailer)
2 ea. Spare Mast carriers (Y-type, mounted to left side of trailer)
2 ea. Antenna Transport Tubes (mounted to top of trailer)
1 ea. Luggage Carrier (mounted to top of trailer, used to carry camping equipment)
1 ea. Trailer Light Indicator Box (used to indicate good input to trailer lights, mounted on trailer tongue)

where he lives, the sun will provide enough current to really cut down on generator use.

In addition to the trailer-mounted equipment, Tom has a small communications package set up in a "flyaway" format where a VHF and UHF rig are mounted on a suitable power supply. These then pack in a small case with cables,

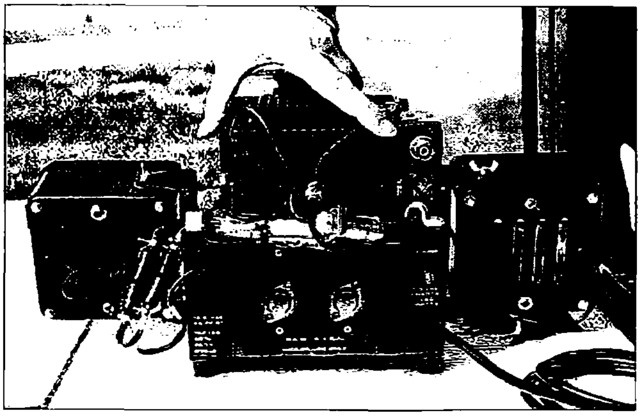

Photo J. Diplexer port. A single run of coax and one antenna saves space and tempers when setting up in a command post area.

mikes, and all else you need to operate a small line-of-sight station. A companion roll carries antennas and cords, etc. It does require a source of steady AC power, but has the advantage of being a sweet "command post" rig setup. Walk in, plug in, string a set of coax cable, plug in the antennas, and you are set to go. The fold in/out speakers are a nice touch. I almost always use a set of cans — it cuts down on the noise and confusion, and permits a degree of privacy.

Field logistics support is more than trying to find a rent-a-can and enough clean water to make coffee. Tom has set his

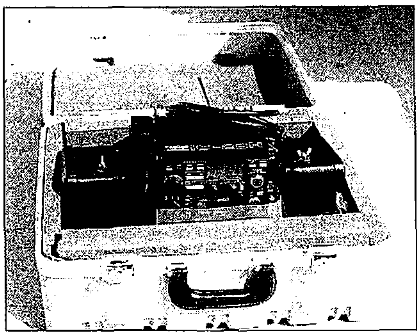

***Photo K.** Flyaway kit in transit kit. Padded, waterproof, and ready to go.*

rig up to provide shelter; water and fuel storage; and cooking facilities as part of the basic package. A set of cots, sleeping bags, some 5 gallon jugs of water, and you have the advantage of being self-contained. I personally hate to cook while in the field, unless that is the reason for being out. Between Meals Ready to Eat, "Heater Meals," and granola bars, I am all set. I do carry a small stove for heating water. Tom has set his outfit up one better, with a two-burner gas stove. This allows for cooking at a comfortable height and out of the weather. In whatever you choose to do for cooking, don't forget to plan for a way to wash up and clean hands, pots, and dishes. Tom has set his storage areas up to fit inside/on top of the trailer.

I plan to and can go completely self-contained for at least 72 hours – and even at that, the only "refill" is for potable water and gasoline. I have spent considerable time in the Alaskan "bush" and in the field with the military — and have developed a style that works for me in remote areas. Not everybody is the same. Take the time to decide what you will want to carry and do a complete pack out. Then go use it in a *non-emergency* situation — Field Day comes to mind as a perfect excuse to exercise your plan. Standing in the rain with people desperate to communicate is no time to find out your cables don't fit, you need an extra plug for the headphones, or are missing the special cable you left back at the shack. And don't forget the spare fuses, tool kit, etc.

The trailer equipment lists are in the sidebars. Not everyone will have a need, nor the desire to build, an allband (HF to UHF) outfit like Tom. Not everybody collects mil-spec communications equipment as a hobby. Perhaps a smaller flyaway kit reflects your needs or requirements. In any case, even if you leave your rigs in the shack, a pre-wired and -tested transport/operation outfit will allow you to save time, protect your equipment, and, when the real thing hits, maybe even save some lives. Thanks to Tom, I am working on my new field rig right now.

Tom Eggers N3JNJ, the subject of this article, can be reached at [tomsprint@earthlink.net]. 73

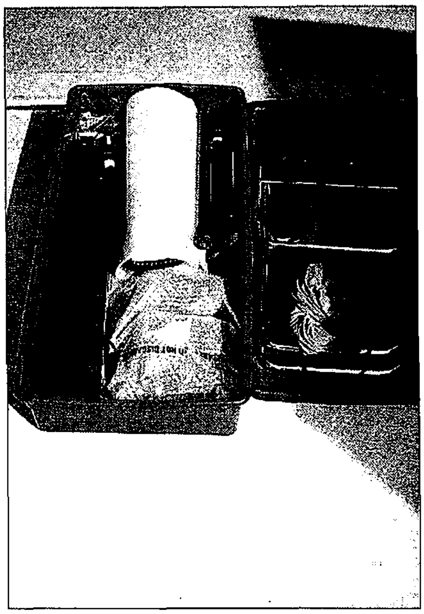

***Photo L.** Antenna and cable roll is part 2 of the flyaway kit. You can carry this onto a commercial airliner and be ready to operate 10 minutes after arrival.*

***Photo M.** Deployed and ready.*

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Bookbind THIS! — Part 2

Get organized, and save money, too.

Part 1 of this series on bookbinding techniques discussed the need for hams to save valuable technical information by binding it into single annual volumes and to recover some needed shelf space in the process. A listing was provided for the materials and tools that I've found useful in making the process successful.

This part will discuss the typical types of bindings used by popular publications that a ham is most likely to encounter, along with separating pages and suggestions for thinning out the volume, and ending with a discussion of the binding fixture.

Binder types

There are several methods that publishers use to bind their magazine issues. I'll describe three of them and indicate the techniques that I use for extracting the pages from each.

Saddle-stitch

73 Amateur Radio Today uses a saddle-stitch technique where all of the double-size pages of the issue are stacked and stapled along the stem, then folded on the stem. Taking the issue apart requires pulling the staples (see **Photo A**) and cutting the double page along the center of the stem, then stacking the pages in page order. Each issue will then be an individual stack of pages and appear as shown in **Photo B**.

The process that works for me after the staples have been pulled is to place the issue opened up fully with the cover and back facing upward and on top. The cover and back are lifted and cut apart, making two individual pages. Those two pages are then laid onto the table (cover face down, rear of back facing down), with the cut stem of each facing one another — as if the issue were merely opened up fully. As each additional page is cut, it is laid onto the respective stack until all pages are completed. The last step is to pick up the "rear" stack and lay it onto the "cover" stack such that all pages are again facedown and in the proper page

***Photo A.** Staple being removed by slipping scissors under the staple.*

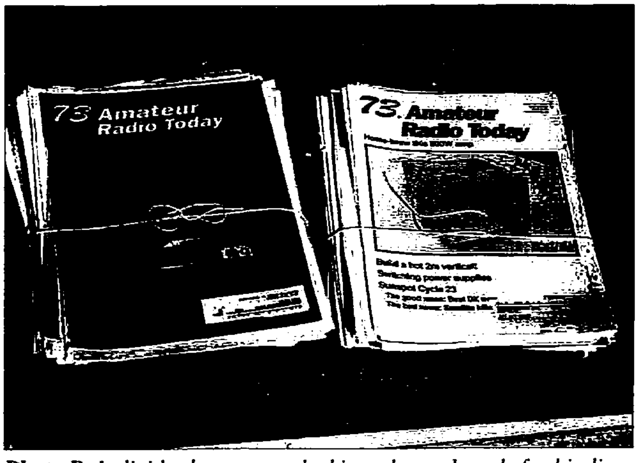

***Photo B.** Individual pages stacked in order and ready for binding.*

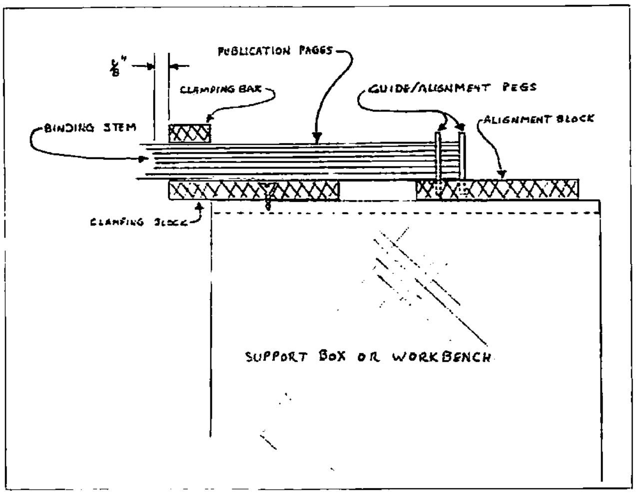

Fig. 1. Clamping and fixturing details.

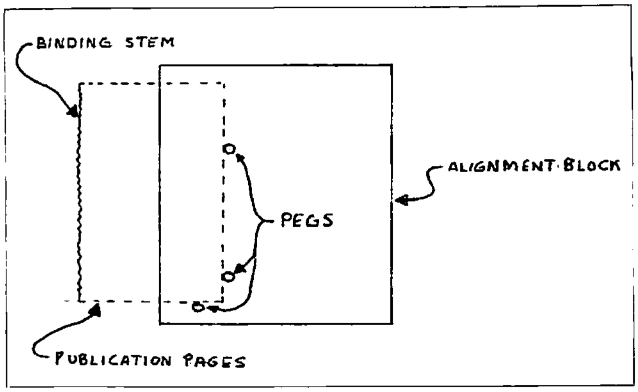

Fig. 2. Top view of guide/alignment pegs and alignment block.

order. Move the stack, cover down, to the side where the next issue in line will be placed on top of it, until the annual publication volume resides in a single stack with January on the bottom and December on the top.

Glued stem

A common technique used for holding a thick volume together is to stack the individual pages and apply glue to the stem, then add a cover — which is the basic technique that will be described herein for ham use. This is a form of "perfect" binding (as is the one below), which means that the cover and pages are held together with adhesive.

Taking the glued stem issue apart requires more effort than that required for a saddle-stitched issue. The process that I've found to be effective is to open the issue to the approximate center, then grasp the two sections, one in each hand, and pull them apart, separating the sections at the stem.

NOTE: Care must be taken because it's possible to tear a corner section out of a few pages.

Once separated into two sections, the magazine sees its back half laid aside temporarily while the front section is taken apart page by page. The cover is opened from the bulk of the pages and carefully pulled away from the glued stem. It is then laid face down. The next page, or two, can be removed by pulling it from the stem. The last few remaining pages may retain the bulk of the original glue. If the pages are to be eventually saved, the glue will have to be stripped off. I've found that it's easily removed by pulling on it with fingernails used as a tool. Tougher situations may require the judicious use of scissors to remove the glue without sacrificing the paper's edge.

As each page is removed it is laid onto the stack until all pages are completed. All of the pages are again in proper page order. Move the stack, cover down, to the side where the next issue in line will be placed on top of it, until the annual volume is complete in one stack with January on the bottom and December on the top.

Bound multiple saddle sections

If you've ever looked at the "construction" of a hardbound book, you'll notice that because of the thick volume, small sections of the book are folded at the stem, then stacked with other such sections. The "book" is then made up of a series of stacked saddle-stitched sections bound together to form a complete book.

Some soft cover publications are also made up of the multiple saddle sections. Once assembled, the stack is "side" stapled through all of the sections. A paper cover is then glued over the stack.

Taking the issue apart requires first removing the cover and back, and then pulling the staples. Care must be taken to keep the individual sections in order as they are cut into individual pages. If care is taken, the numbering will be correct after all of the pages are restacked.

Once all of the pages are again in proper page order, move the stack, cover down, to the side where the next issue in line will be placed on top of it, until the total annual volume has been completed with January on the bottom and December on the top.

Thinning the annual volume

Now is the tricky part, because it is necessary to make some very tough decisions on what to save and what to discard. Here is the way I approach the situation. I start by turning over the entire stack, placing the January cover on top. Turning one page at a time, as if reading the book, I place the cover face down as a first step. On top of it I place the table of contents for that issue, followed by the articles that I wish to save. The saved pages remain in page order as the sorting process continues. It is important to also save the pages containing the continuation of each saved article. To save shelf space, I discard the rear cover of all issues except for December, the last issue and page in the stack. Be sure to save the annual index, should one appear within the volume.

Binding fixture

This is an area of the process where you must draw upon whatever tools and equipment are available. In my case, I happened to have a large wooden packing box that I use as a binding table. Most any stand or workbench will be suitable if it is convenient to use.

To accommodate various page sizes, I've used two pieces of wood of equal thickness (**Fig. 1**). One is a clamping block that is affixed to the stand/workbench. This block is longer than the longest page that will ever be encountered — mine is about 12 inches long.

Residing behind the clamping block is a guide/alignment block as shown in **Figs. 1** and **2**. On the block are three pins that may be either wooden pegs or large nails that are positioned with a square. These pins are used to align all of the loose pages into a neat stack prior to binding. Alignment needs to be done on only the front edge and one end of the page. Because the various monthly issues are cut at different times, there will be a small variation in the page length and width, leaving one edge of the newly bound volume a little "ragged."

When placing the loose pages onto the binding fixture, it is first necessary to lay down, for alignment, the narrowest page within the stack. As shown in **Fig. 1**, the narrowest page(s) should extend beyond the clamping block by approximately one-eighth of an inch.

To hold the alignment block in place after aligning the pages, some heavy weight or clamps may be used. The weight is placed on the rear portion of the block to reduce the tendency for it to shift position.

Each page is laid down one page at a time, with the smooth edges toward the alignment pins. The ragged stem extends beyond the edge of the clamping block, where it can be reached for trimming.

When all of the pages are neatly stacked onto the clamping block, a weight is placed temporarily on top of the pages to keep them from drifting in the breeze. A clamping bar is placed over the top of the stack so that the edge of the bar runs parallel with the edge of the clamping block.

"C-" or expandable wood clamps are then used to clamp and apply pressure to the paper stack. How tight must the clamps be? That's a tough question to answer, but the answer can be determined when rasping begins. If the pages tend to move, then the clamping pressure isn't high enough. Another gauge is that the tighter the stack, the easier the paper is to cut with the rasp. Too tight, though, will cause the clamping bar to bend and the pages to twist or shift under clamp pressure. Yes, a happy compromise is desired.

Part 1 of this series provided a listing of materials and tools needed for a ham to bind important technical documents. Here in Part 2, we have provided details of how publications are bound and the way they can be taken apart. Part 2 also provided the details for setting up the binding equipment in preparation for rasping and gluing the stem of the new volume. Part 3 will follow, and provide the steps involved in rasping and gluing the stem, followed by the making of a cover for the "new" annual volume. 73

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Read All About It!

Part 6 of good stuff from The Hertzian Herald.

All about The world of decibels; I am, therefore I ham; and Radio bug bites boy.

Great signal here, OM. You're peaking 20 dB over S9. This receiver has a 50 dB notch filter and it took that carrier right out.

Decibels (dB) are everywhere in ham radio, but how many hams understand them? The first point to grasp is that a decibel does not represent an amount, like a volt or a watt — it represents the ratio of two power levels.

Consider an amplifier that receives a 1 W input signal and delivers a 10 W output signal. It has a gain of 1 bel, or ten decibels, or 10 dB. (The original unit Bel, developed at the Bell Telephone Labs, was deemed too clumsy, so it was split into tenths.) The formula for getting from power ratio to gain (G) in decibels is G = 10log(P2/P1). In our example, G = 10log10 = 10 x 1 = 10 dB.

The logarithm (log) of a number is the power that you have to raise 10 to get that number. The log of 10 is 1; the log of 100 is 2; the log of 1000 is 3; and so on. Logs do not have to be whole numbers. For example, the log of 316 is 2.5. Literally, this means that we multiply 10 by itself (or 2 times), getting 100, and then by a half a time (square root of 10, or 3.16) getting 316. Extending this idea, we can (with a calculator) get a log for any number. For example, log 567 = 2.754.

Now we are in a position to see how decibels can be more useful than simple power ratios. Let's say we have two amplifiers in cascade. The first builds 1 W up to 10 W (a gain of 10 dB) and the second builds 10 W up to 100 W (also a factor of 10, or 10 dB). The overall power ratio is 10 x 10, or 100 times. However, the overall decibel gain is 10 dB + 10 dB, or 20 dB.

Decibel gains don't multiply; they add. Going back to our formula: G(tot) = 10log(100 W/1 W) = 10log100 = 10 x 2 = 20 dB. If this seems confusing, remember that a decibel is a log, and a log is a power of ten. And when you add another power of ten you multiply your result by ten.

Perhaps the example of two x10 amps is too simple to make the point. Let's consider a first amp with a power gain of x39 (which is 16 dB), feeding a second amp with a power gain of 6.3 (which is 8 dB). Using power ratios, the overall gain is: A(tot) = A1 x A2 = 39 x 6.3 = (can you do that in your head?).

But in decibels, it's easy to do in your head: G(tot) = G1 + G2 = 16 + 8 = 24 dB.

As another example, let's say that we have an amplifier with a power gain of x39 feeding a transmission line with a loss factor of "divide by 6.3." "Divide by" in power factors is represented by negative decibels, so the overall gain is: G(tot) = G1 - G2 = 16 - 8 = 8 dB.

When an entire communications system operates in the dB system,

dB	V/V
3	1.41
6	2
10	3.16
20	10
30	31.6
40	100
50	316
60	1000

Table 1.

Reprinted with permission from *The Hertzian Herald,* newsletter of the Monroe County (MI) Radio Communications Association (MCRCA).

keeping track of the signal level at any given point is a simple matter of adding and subtracting decibels. Like the English-vs.-metric conflict, the conversions are the hassle. If you just stay in the more efficient system (metric or decibel) your measurement and calculation burden is greatly eased.

Here's a practical tip: Nobody writes mA = 32. That's obviously improper. You should write I = 32 mA. Similarly, you should not write dB = 32 (although many people do). The proper way is to write G = 32 dB.

Once again, the formula for gain (G) in decibels is: $G = 10\log(P2/P1)$

If the gain is actually a loss, and P2 is smaller than P1, the value of G becomes negative. (Try it on your calculator — a power gain from 1 W to 2 W is 3 dB; a loss from 2 W to 1 W is -3 dB.)

Voltage is much easier to measure than power, so we would like to be able to determine dB from voltage measurements. This is possible IF the two voltages, V1 and V2, are measured across equal resistances. Since power varies as the square of voltage, and doubling a log squares the number, the voltage-ratio-to-dB formula is: $G = 20\log(V2/V1)$.

We must emphasize that this equation is valid ONLY if V2 and V1 are measured across equal resistances.

People who work with decibels a lot soon commit **Table 1** to memory. Using the table, you can quickly see that 26 dB is 20 dB + 6 dB, which is a voltage ratio of 10 x 2, or 20 times. As another example, 37 dB is 40 dB - 3 dB, a voltage ratio of 100/2 = 50 times.

Notice that decibels are nonlinear: 40 dB is not twice the voltage ratio, nor twice the power ratio, as 20 dB.

OK, so we can convert power ratios, or voltage ratios, to decibels. How do we go the other way: dB to gain factors? Here are the formulas: P2/P1 = inv-log(dB/10) and V2/V1 = inv-log(dB/20). The inverse-log key on your calculator may be labeled log -1, or 10-to-the-x power.

We have said repeatedly that decibels specify a ratio, not an amount — but engineers often do specify a signal level in dB. This is possible because they are assuming a standard level for P1 or V1. In the audio industry, the standard (0 dB) level is 1 mW. Thus a 2 mW signal is 3 dB, and a 10 mW signal is 10 dB. In cable TV, the standard is 1000 μV on 75 ohms, so a 500 μV signal is -6 dB.

Finally, let's try to put decibels into an everyday context. The threshold of audibility for humans under ideal conditions is the 0 dB reference level. A whisper is 15 dB; average conversation is 55 dB, and 85 dB is a jackhammer. A 1 dB change is just about the smallest perceptible change. A 10 dB change is what most listeners would judge to be "twice as loud," although, of course, it is actually

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Read All About It!

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ten times the power, or 3.16 times the voltage.

I am, therefore I ham

"Hi, Art. How's it going?"

"Oh, not bad. How are you?"

"Can't complain. Hot enough for you?"

"Is it! I'm ready for fall."

"Me, too. Well, take it easy."

"OK. See you later."

I have conversations of this same innocent type half a dozen times a day, at least, with neighbors or colleagues at work. It's a pretty pointless conversation from an objective standpoint, yet the cumulative effect of these exchanges is to make us feel that we "belong" in our neighborhood or work community. How would you feel, for example, if you met a neighbor on the sidewalk and he refused to exchange these few meaningless words with you?

Then why is it that hams are constantly berating themselves about how the QSOs on 2 meter FM, or 75 phone, or 40 CW are repetitious, mechanical, and boring? We don't expect scintillating discourses on social improvement or astrophysics from our neighbors. Why do we expect it of hams we meet casually on the air?

Perhaps the bar was raised in the '30s and '40s when some rather special conditions prevailed in ham radio. Nearly all hams built their own gear then, and the technical experience landed many of them good jobs in radio and TV. Ham radio often provided the only means of communications in an emergency. And trans-oceanic QSOs were the stuff of magic in the days before satellites. By contrast, today's "rice boxes" provide little in the way of technical training, ordinary QSOs pale beside the remembered SOS calls of yesteryear, and any Joe on the street can punch up a call to Europe on his cell phone.

Columbus, Magellan, and Cook made their courageous voyages of discovery in sailing vessels because that was the technology of the time. New technology has made sailing obsolete, commercially; but thousands of enthusiasts still ply the waters of Lake Erie in sailboats — just because they love sailing. And they make no apologies because they may not be advancing the science of transportation, may not be carrying any useful cargo, and may not even be going anywhere.

Ham radio is a hobby. We do it because we love it. It is as worthy a hobby as sailing or golf or guitar playing. And it is as worthy a use of spectrum space as most of what occupies the AM, TV, and shortwave broadcast bands. We have no apologies to make because it is no longer the life-saving, cutting-edge hobby that it was in 1936.

Hams often talk doomsday because so few young people are coming into the hobby. It is true that in 1958, when I got into it, half the hams on the air were kids. Today, the teenagers mostly gravitate to computers rather than ham radio. This is as it should be — they're going to be looking for jobs, and they know where those jobs are. But still, I talk to many, many new hams. Typically, they're in their late 40s. Their kids are grown, and now it's time to take up a hobby.

We need to loosen up and simply enjoy this great hobby of ours. It's doing just fine, and will probably outlive most of us.

Radio bug bites boy

The most anticipated present that Christmas of my eighth-grade year was a Red Ryder BB gun, but in a small box (left toward the end, as probably containing only clothes) was a one-transistor AM radio kit — really little more than a crystal set as I look back on it. In the snow and slush I strung the fifty feet of aerial wire from my bedroom window to the old pear tree, and fell asleep many a January night listening to WSPD, WJR, and CKLW — usually simultaneously. It was 1957, but I wasn't interested in Buddy Holley or Elvis Presley — I was absolutely fascinated by the feat of pulling voices out of the air from fifty miles away. It was magic.

Of course, I had grown up listening to The Lone Ranger and Sergeant Preston of the Northwest Mounties on the superhet in the living room; by 1954, that set had been replaced by a 17-inch black-and-white RCA television, but these were just appliances — pieces of furniture — whose innards were no more to be comprehended than those of the bus that took me to school. My little radio had only five or six parts. Maybe I could find out how it worked.

By spring, I had read every "Boy's Book of Radio" in the library, but my experiments had led to the demise of my one-transistor radio. Efforts to build my own radio from plans in the "Boy's Books" were proving unsuccessful. I remember stripping yards and yards of vinyl-insulated wire left behind when a phone-company truck drove away; somehow I had become convinced that a tuning coil had to be wound with bare wire.

Finally, in desperation, I cracked open my piggy bank and plunked down all eighteen dollars for a Philmore two-tube-plus-rectifier regenerative radio kit, with AM plus 6 to 18 Mc shortwave band (whatever that meant). The Allied Radio Ocean Hopper and the famous Heathkit AR-3 were available at that time, but we had never heard of them or seen their catalogs — and the wiley old coot at the radio store was not about to enlighten us. My father and I built that radio on a card table in the kitchen, heating the non-electric soldering iron on the burners of the stove. The directions were mimeographed and sketchy, so I marvel still to think that we got it working first time. I still have the schematic: 12SJ7 regen-detector, 50L6 audio amp, 35Z5 rectifier. Pretty standard layout.

I spent the first week or so listening to the BBC, the Voice of America, and Radio Moscow. Pretty heady stuff, in the days before long-distance telephone calls were common, to hear the commies talking to you direct. But before long, I discovered the ham bands. SSB was just getting started in '57, so there were lots of AM stations to be heard. I started picking up the jargon: QTH, RST, CQ, OM, QRM. It slowly dawned on me that I could become a transmitting "ham" and that it required knowledge of the Morse code. I made

flash cards (quite useless) in an effort to learn it.

In September I started high school, and the school had a radio club. At last, I had some upperclassmen I could talk radio with — and who would send me code practice. By mid-November of '57, I was picking up snatches of CW from the 40-meter Novice band on that clumsy regenerator. (I still have the SWL log I kept of all my eavesdropping.) Christmas of 1957 was quite a harvest: a Hallicrafters S-38E receiver (4 tubes plus rectifier), an Eico 1000-ohm-per-volt multimeter, and an electric soldering gun. My listening-in took a strong turn away from AM and towards CW as I prepared for my Novice test.

The Rev. Alfred Schindler, pastor of St. Catherine's Church, gave me that test on Feb. 15, 1958. I had attended his church and school for years, but had no idea that he was W8OXK. To me, he was the venerable and somewhat distant prelate who officiated up at the altar. I was rather astonished when, instead of giving me the regulation five minutes of text at a measured 5 wpm, he just tapped out eight or ten letters, saw that I was copying it, and announced that I had passed.

In the two months it took the FCC to process my license, Dad and I built a Heathkit DX-20 transmitter and strung a 40-meter dipole from the house to the garage. Shortly before the big day, Dad discovered that Joe W8LNV lived just two blocks down the street, and he agreed to be my first QSO.

On April 16 the ticket arrived — I was KN8JWR. I called Joe to arrange a QSO, but I hadn't the slightest idea what to say, and my fist was shaking so violently, I'm sure my CW was unintelligible. The big problem was finding my frequency on the receiver. Every time I touched the key, even with both antennas off, there was this big BLATT that blanked out the whole Novice band.

Eventually, I read Joe sending congratulations and telling me to get off on my own and make a QSO. So, with my hand still trembling, I sent: CQ CQ CQ de KN8JWR, took the receiver off standby, and listened.

The word "crowded" does not even begin to describe the condition of the 40-meter novice band in 1958, when I got my license. The only thing that approaches it today is Field Day or Sweepstakes — but, of course, the CW was slower. I did a little survey of my Novice-days' QSLs: two thirds of us were using receivers without crystal filters. The bandwidth was about 6 kHz, so we usually heard at least six stations at once. A common challenge was to set the dial at random and see who could copy three different stations without touching the dial — just by concentration.

In 1958, about 70% of us were using transmitters built from kits, 20% had home-brews, and 10% had commercially built rigs. If you could copy a signal report, a name, and a state before the QRM clobbered the guy, it was a good QSO. Postcards were 2 cents (until August, when they went to 3 cents), and if you could get a city and an address through so you could exchange QSLs, it was a cause for celebration. If you couldn't get it through, you had to wait until your call appeared in the next year's *Callbook* to get your QSL; no Internet callsign servers then.

Well, I put out CQs for about ten minutes that first night, and was lucky enough to copy KN9JSK coming back. It took ten minutes to get his state and a signal report (489) through the QRM — then he was buried in it. (I still have the QSL from that first contact — it's displayed in the top left slot on my bulletin board.) I called a few stations and sent a few more CQs, but heard no more replies. Then it was ten o'clock and QRT — school night, you know.

The next day, I got on right after school and found the band somewhat less crowded. I had a 50-minute ragchew with Wisconsin, and then worked North Carolina. In a month I had worked 14 states, as far out as Texas. During the next summer break, I once got up at 4:30 a.m. to get away from the QRM, and worked Oregon — the West Coast at last!

How can someone of today's generation understand what direct communication over such distances meant to a 14-year-old in 1958? I had never been outside the states of Ohio and Michigan. This was way before cell phones and the Internet. It was before direct-distance dialing and satellite relay — Sputnik had gone up less than a year before. I remember Dad with his hand over the mouthpiece of the phone saying, "It's long distance," and Mom replying as a matter of course, "Who died?" In those days long-distance calls were for emergencies only.

That autumn I got my General ticket and began knocking off states toward my WAS on 20 meters. (I remember my civics teacher's astonishment when I filled in a map with the name of every state in about five minutes: It was a snap — I had worked most of them.) Soon after, I started working a little DX on 15 meters. Any DX was rare then, and pileups for the DX stations were awesome. It was only 13 years after the devastation of WW II in Europe, and I suppose those folks were still struggling for basic necessities, with little time or money left over for hobbies.

In January, I hooked up the output of an old two-watt phonograph amplifier to the screen-grid of the 6DQ6 final of my DX-20 transmitter and went AM with 32 watts input. (Transmitters were never rated by RF output then.) I had run into a number of local teenage hams by then, and we began congregating on 75-meter phone every day after school — the Teen Net of Toledo, we called it. We formed our own teenage radio club, with perhaps 30 members. Meetings rotated around to members' shacks, and we put on some spectacular Field Day performances.

I'd say it was ham heaven, although I didn't realize it at the time, and I'd give anything to be 15 again, climbing a tree to secure the end of a Field Day antenna at Side Cut Park.

By Eric Shalkhausser W9CI, SK

The History of Ham Radio

Part 5: The first convention.

The first amateur radio get-together of any size was the St. Louis Midwest Convention in December of 1920, shortly after our licenses became available in 1919. No sooner had the enthusiasm at the St. Louis gathering died down than the ARRL Board of Directors proposed a national convention.

In these early years after World War I, there was so much newness in everything connected with wireless, and there were so many original and worthwhile ideas to be aired, that no mere Morse code contact was sufficient. Voice communication had not as yet entered our amateur wireless channels. Amateurs were on the verge of many new developments. Major Armstrong had announced his "single" signal regenerative and then his superregenerative receiver designs. There were new circuits to be tested in the transmitter field, including the Colpitts, the Meissner, the Hartley, and the Heising, among others.

Amateurs wanted to be informed. They found themselves in new technical surroundings. So, for the first time, citizens of the United States and Canada, all interested in privately owned and operated radio communication, decided to come together from far and near to a big first national convention.

Reprinted from *73 Amateur Radio*, December 1977, where this was originally reprinted from *QCC News*, a publication of the Chicago Area Chapter of the QCWA.

The first gathering of the clan took place from August 30 to September 3, 1921, at the Edgewater Beach Hotel, located on the shore of Lake Michigan in Illinois. History relates that, following the success achieved at this first national convention, it was ordained that two succeeding ARRL national conventions were also to be held at the Edgewater Beach Hotel in Chicago at two-year intervals — September 11 to 15, 1923, and August 18 to 23, 1925.

There was no telling what impact these get-togethers would have on the future destiny of amateur radio. Great effort and meticulous preparations were made for months in advance to ensure success. Everyone connected with the preparations hoped that this first national meeting would find attendance coming from the far reaches of the States and Dominions, representing all districts.

The midwest location proved to be a most strategic and advantageous choice. The Edgewater Beach Hotel was at the far north edge of Chicago, away from heavy traffic, with R.H.G. Mathews' 9ZN station located just to the north on the lake shore, sporting two tall station towers, a multiwire antenna, and up-to-date equipment in his spacious shack. All agreed that this was an ideal spot to congregate.

The convention committee had booked a large arena, the Chicago Broadway Armory, located within walking distance of the hotel. About fifty manufacturers and dealers in ham radio gear of all descriptions displayed and demonstrated their products. For the first time, amateurs had an opportunity to talk shop with those people who had kept amateur radio alive through their advertising in *QST, Radio Amateur News, Wireless Age*, catalogs, and other literature. This was a ham's paradise!

The convention hall, where all the sessions took place, was a beehive of activity. There was no let-up in making personal contacts, exchanging QSLs, and discussing many subjects slated on the agenda.

The first day

The ARRL president, Hiram Percy Maxim, addressed the members with an inspiring talk concerning the aims and accomplishments that amateur radio had achieved in the relatively few years of the ARRL's organization. In

***Photo A.** Advertisement for the First National ARRL Convention & Radio Show in Chicago, August 30th to Sept. 3rd, 1921.*

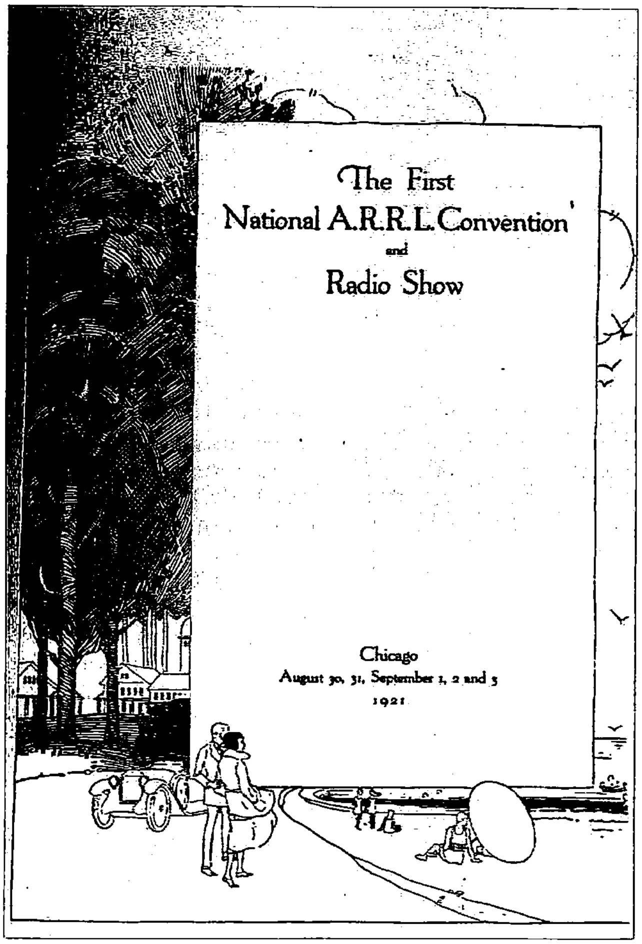


***Photo B.** Convention announcement opening sheet.*

his introductory remarks, the founder of the League had the following to say:

"As we meet and open this great convention, it is indeed a historic event. ... In years to come, much will be said about what we do here at this first convention. We are striking out into the unknown, and even the smaller actions which we take here during the next few days will weigh heavily in the future, for they will establish precedents and standards. ... Let us not forget that we are pioneers, blazing a way many are to follow. Our responsibility is great, and we must so regard it. It is one thing to repeat what has already been done, but it is another altogether different thing to do what has never been done before. What you see before you here today has never happened in the affairs of man. Not only is it a great pioneer effort in radio history, but it is a great pioneer effort in political history. We American and Canadian citizens assembled in this room represent pioneers in the development of something totally revolutionary in the art of communication. The like of what we are doing and proposing had never crossed the brain of man a short ten years ago. We already have a privately owned, absolutely free, continent-wide means of instantaneous communication, and no man may say we shall not make it worldwide." (What prophetic statements emerged from this gathering of dedicated and enthusiastic men!)

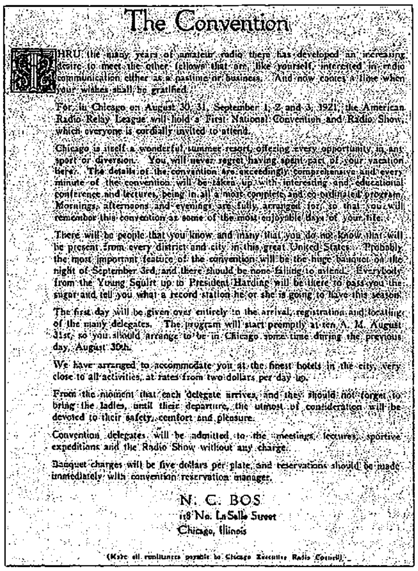
"It is no small distinction," our president went on to say, "to be one of those who make history."

General and technical sessions

There would be no point in listing the names of the high and low notables in attendance. They were all present. The program committee had topics scheduled for discussion pertaining to club organization, interference control, observations of laws, legislative matters, message handling, and many technical subjects.

Charles H. Steward, member of the ARRL legislative committee, reviewed pending legislation, a matter which required constant attention. Seven bills under debate in Congress at that particular time related to subjects concerning radio control, radio regulation, and enforcement. Observations made at this meeting were that: "If just two of these bills go through in their present form, the wavelengths, power, and decrement are then subject to control of the Commission, and they keep us champing around from one wavelength to another, increasing and decreasing the power available for amateurs. Constant vigilance is of vital importance to ensure the amateur's place in the radio spectrum."

Probably the topic that drew top attention during the convention, and that was subject to heightened debate,



The Convention

THRU the many years of amateur radio there has developed an increasing desire to meet the other fellows that are, like yourself, interested in radio communication either as a pastime or business. And now comes a time when your wishes shall be gratified.

For, in Chicago on August 30, 31, September 1, 2 and 3, 1921, the American Radio Relay League will hold a First National Convention and Radio Show, which everyone is cordially invited to attend.

Chicago is itself a wonderful summer resort, offering every opportunity in any sport or diversion. You will never regret having spent part of your vacation here. The details of the convention are exceedingly comprehensive and every minute of the convention will be taken up with interesting and educational conference and lectures, being in all a most complete and co-ordinated program. Mornings, afternoons and evenings are fully arranged for, so that you will remember this convention as some of the most enjoyable days of your life.

There will be people that you know and many that you do not know that will be present from every district and city in this great United States. Probably the most important feature of the convention will be the huge banquet on the night of September 3rd, and there should be none failing to attend. Everybody from the Young Squirt up to President Harding will be there to pass you the sugar and tell you what a record station he or she is going to have this season.

The first day will be given over entirely to the arrival, registration and locating of the many delegates. The program will start promptly at ten A. M. August 31st, so you should arrange to be in Chicago some time during the previous day, August 30th.

We have arranged to accommodate you at the finest hotels in the city, very close to all activities, at rates from two dollars per day up.

From the moment that each delegate arrives, and they should not forget to bring the ladies, until their departure, the utmost of consideration will be devoted to their safety, comfort and pleasure.

Convention delegates will be admitted to the meetings, lectures, sportive expeditions and the Radio Show without any charge.

Banquet charges will be five dollars per plate, and reservations should be made immediately with convention reservation manager.

N. C. BOS
118 No. LaSalle Street
Chicago, Illinois

(Make all remittances payable to Chicago Executive Radio Council)

Photo C. *Announcement for the first Convention, 1921.*

proved to be the controversial question of power factor in ham transmitter circuits. As one reporter remarked afterward, "Without a doubt, this debate was the main attraction at the convention."

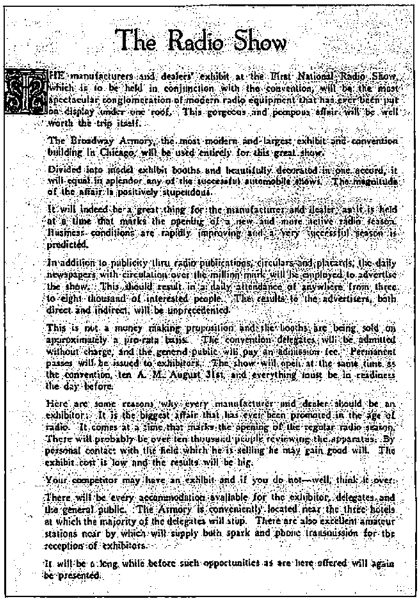
There were staunch supporters of the two main participants in the discussion, and it did not take long before sides were chosen. At the outset, Ellery W. Stone from the west and W.B. West 8AEZ were the antagonists in this struggle for definition and thoroughness of detail for presentation of facts.

Said Mr. Stone: "Power factor is unity in any AC circuit in which inductive and capacitance reactances cancel."

Said Mr. West (ignoring inductance and capacitance): "I confine my views in the matter to the relation of real watts to apparent watts."

This confrontation went on for hours, with other participants joining, until all agreed that it appeared that the confusion lay in the definition of power factor. There was no common understanding reached by the two parties. So it was decided, on the spot, to submit the question to the radio section of the Bureau of Standards, Washington, DC. The statement submitted to the Bureau read as follows:

"For information of National Convention of ARRL, please wire our expense immediately: In a freely oscillating radio circuit, and in a forced oscillating circuit tuned to resonance with the impressed frequency, if the inductive and capacitive reactances are equal in magnitude and opposite in sense, is the power factor unity? One side contends that, according to present alternating current theory, the power factor is unity, and reactances are equal and opposite. Other side contends that resonance is that condition in circuit which causes power factor to automatically assume that degree necessary for the complete dissipation of the power applied to the circuit."



The Radio Show

THE manufacturers and dealers' exhibit at the First National Radio Show, which is to be held in conjunction with the convention, will be the most spectacular conglomeration of modern radio equipment that has ever been put on display under one roof. This gorgeous and pompous affair will be well worth the trip itself.

The Broadway Armory, the most modern and largest exhibit and convention building in Chicago, will be used entirely for this great show.

Divided into model exhibit booths and beautifully decorated in one accord, it will equal in splendor any of the successful automobile shows. The magnitude of the affair is positively stupendous.

It will indeed be a great thing for the manufacturer and dealer, as it is held at a time that marks the opening of a new and more active radio season. Business conditions are rapidly improving and a very successful season is predicted.

In addition to publicity thru radio publications, circulars and placards, the daily newspapers with circulation over the million mark will be employed to advertise the show. This should result in a daily attendance of anywhere from three to eight thousand of interested people. The results to the advertisers, both direct and indirect, will be unprecedented.

This is not a money making proposition and the booths are being sold on approximately a pro-rata basis. The convention delegates will be admitted without charge, and the general public will pay an admission fee. Permanent passes will be issued to exhibitors. The show will open at the same time as the convention, ten A. M. August 31st, and everything must be in readiness the day before.

Here are some reasons why every manufacturer and dealer should be an exhibitor: It is the biggest affair that has ever been promoted in the age of radio. It comes at a time that marks the opening of the regular radio season. There will probably be over ten thousand people reviewing the apparatus. By personal contact with the field which he is selling he may gain good will. The exhibit cost is low and the results will be big.

Your competitor may have an exhibit and if you do not—well, think it over.

There will be every accommodation available for the exhibitor, delegates and the general public. The Armory is conveniently located near the three hotels at which the majority of the delegates will stop. There are also excellent amateur stations near by which will supply both spark and phone transmission for the reception of exhibitors.

It will be a long while before such opportunities as are here offered will again be presented.

Photo D. *Radio show announcement.*

Within hours after the telegram was forwarded to the Bureau, the reply came back … with an answer that, in essence, left both sides very much up in the air. Supporters of both Mr. West and Mr. Stone hailed the outcome of the reply as complete vindication of their respective sides. Even a committee thereupon appointed to review the entire discussion finally ended up by stating that they were not reasoning from the same premise. Most of those in attendance finally concluded by these vague decisions that another subject could be more productive and down to earth and headed for other meetings.

Of great interest to amateurs who were still purchasing and installing spark gap transmitters was the subject of broadband interference. It was contended that spark gap units were doomed to fade out of ham stations, because the waves they transmitted on the air were not as sharp as a CW wave. It is true that they could be held better in reception and did not have tendencies to jam each other, like the CW signals did. Also, each spark on the band had an individual characteristic that identified it, and what distances could be covered (having 1000

Photo E. *Radio 9ZN description from* QST.

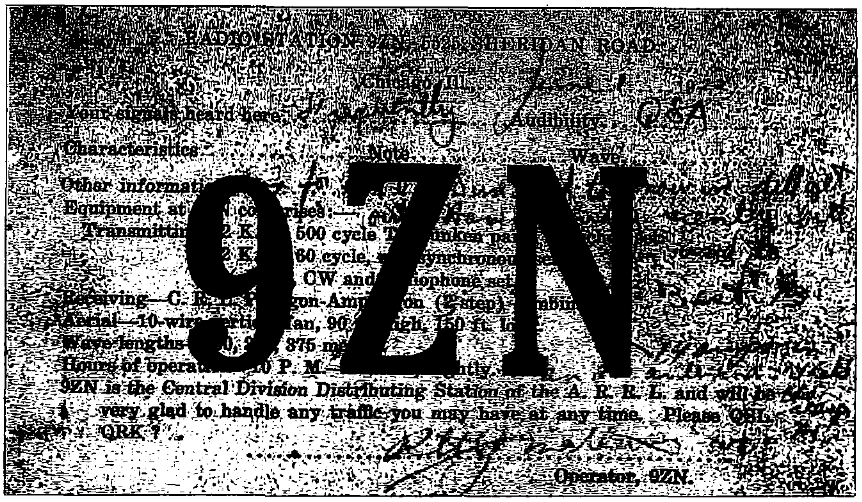


Photo F. 9ZN QSL card, June 1922.

Watts available)! The overall sensitivity and selectivity of circuits was a hindrance. The CW signals were difficult to tune and hold. Wave shifting was usually noticeable. Regenerative receivers had shortcomings, especially since they were asked to be equally effective in bringing in CW, ICW, and the broad spark signals. Receivers lacked adequate control to meet requirements. Being regenerative, they radiated energy and caused considerable interference, especially in more congested areas.

For most signal reception, the oversized loose couplers in station equipment were still serving their major purpose. Domestic and foreign long-wave stations were very much on the air with news broadcasts, weather reports, time signals, and general information. Many stations served as sources of code signals for practice — NAA, 2,500 meters; POZ, 12,000 meters; PL, 10,000 meters; and MUU, 14,000 meters, continued on the air for years.

So loose couplers were in constant use by amateurs until, with the introduction of the honeycomb-coil design, units that occupied far less space but had equivalent inductance gradually replaced them. Amateurs also began to convert to shorter and shorter wavelengths with the move to CW and the application of available transmitting tubes. Amateur station layouts began to take on new and revitalized appearances. Power supplies had to be designed and built to accommodate larger tubes for that new requirement of "juice" for the "bottles." In turn, many new receivers were being built using variometers and variocouplers.

As is the case each year, with the coming of fall and colder weather, radio conditions improved, static tapered off, and interest in DX and relay activities increased. So the ARRL Board of Directors decided that a determined effort should be made to span the Atlantic via amateur radio. There had been an earlier try, not organized, that had failed. Undaunted, plans were laid by the ARRL traffic department announcing that all radio amateurs should enter into a series of transmitter tests. Selections would be made to find the best and most far-reaching transmitters to qualify for the proposed undertaking. The following form appeared in *QST*, September 1921, page 12, directed to all hams:

"Traffic Manager, ARRL, 1045 Main Street, Hartford CT: Please enter my station as a transmitter in the Transatlantic Sending Tests, Dec. 8th to 17th. I will be ready to transmit in the preliminary tests on Nov. 7th to 12th, and if I fail to cover the specified distance in the preliminary tests, I shall relinquish my rights to transmit in the final tests. Name … Call … St … City … State … Power of transmitter … type (CW or spark) … greatest distance heard (give three records) …"

The stated goal was: "We want the Atlantic Ocean spanned on schedule by an amateur station, and we want definite proof that it has been done."

To be continued.

The Digital Port

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More New Stuff

Once again, there is more new stuff out there in digital land. Some of you are helping me find it and get me going. Way to go, guys!

Also, I have received some on-the-air info to help clear up gaps in my gray cells (between the ears). I have enough material before I start this month's column that I am having to pick and choose. Some of this may be just what you are looking for!

To begin, this is the first of the year as I write this, so some of this may be old-hat by the time you get it. However, I will start with a new program that appears in what we might term "standard screen format" for MFSK16. (See **Fig. 1.**) This is HamScope, written by Glen KD5HIO, and it does a lot more than simply put a new slant on this brand new mode recently popularized with the Stream software from Nino IZ8BLY.

The very first impression I had of this program once I got it up and running was that it does about everything, especially considering it is the first release, version 1.21. For starters, I should digress for a few lines and applaud the efforts of the author. When I first installed the program and went to setup, it locked up.

I contacted Glen with a description of what was happening. He was right on top of the problem and explained a process the program went through during the initial setup process. Then he sent a modified version, which is the one currently available for download, and the program has worked the way you would expect ever since.

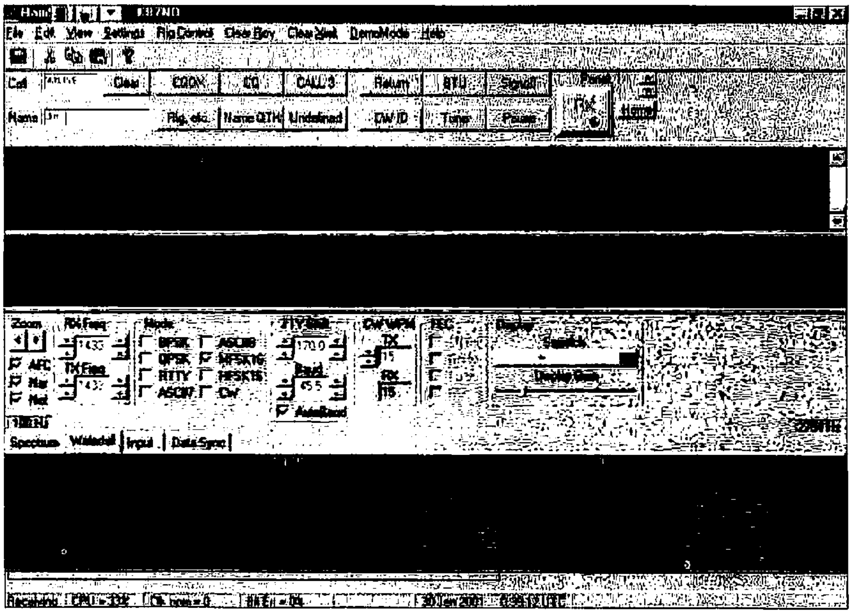

Fig. 1. HamScope screenshot. This is a live shot with two MFSK16 sigs in the waterfall. To tune to the sig on the right, you would simply click on the bright "leg" at the bottom, much as with the Stream software. Included are optional tuning displays other than the waterfall. The receive and transmit panes are resizable. The macros are easily edited and there are more macros just a click away. There are eight selectable modes and a lot of little niceties you will discover as you play with it. It is intuitive. The setup is quick and, as with many of the new programs, you can be on the air in minutes after installation.

At this writing, there are a few rough spots that are noticeable but, hopefully, by the time this print hits your mailbox, those will be ironed out as well. The program is multimode in that it not only does MFSK16, but also PSK31, CW, RTTY, and a unique version of MFSK16 that includes forward error correction (FEC) and is dubbed HFSK16.

The rough spots thus far center on less-than-best RTTY and complaints about the CW decoding. With all due respect to the complainants, even with these shortcomings, the program as a whole is a work of art. The two modes I have used the most are PSK31 and MFSK16, and the performance in these modes is outstanding.

I have made numerous contacts during the past few weeks and have met a number of other users. The acceptance of the format and the ease of tuning the MFSK16 is often echoed. I even gave the optional spectral display a go for tuning and found that display, with a little practice, to be practical for accurate tuning.

The macros are easily edited. This is a priority for me. I like to type ahead, which is supported easily, and with the inclusion of judiciously written macros, my end of the QSO looks a lot like it was written by a proficient typist. A lot of hams have difficulty with typing (more so than I), and if they could see how easy it is to use macros and type ahead while the other station is transmitting, they would be put at ease and attempt these keyboard modes.

To digress a minute, most of us get a little nervous when someone is watching over our shoulder as we type. I find I am just as susceptible to those jitters when my macros and typing crutches have run out and the ham at the other end can observe how I miss keys and have to make corrections. The errors increase exponentially all of a sudden. So, what I am saying is, "Take heart, you are not alone."

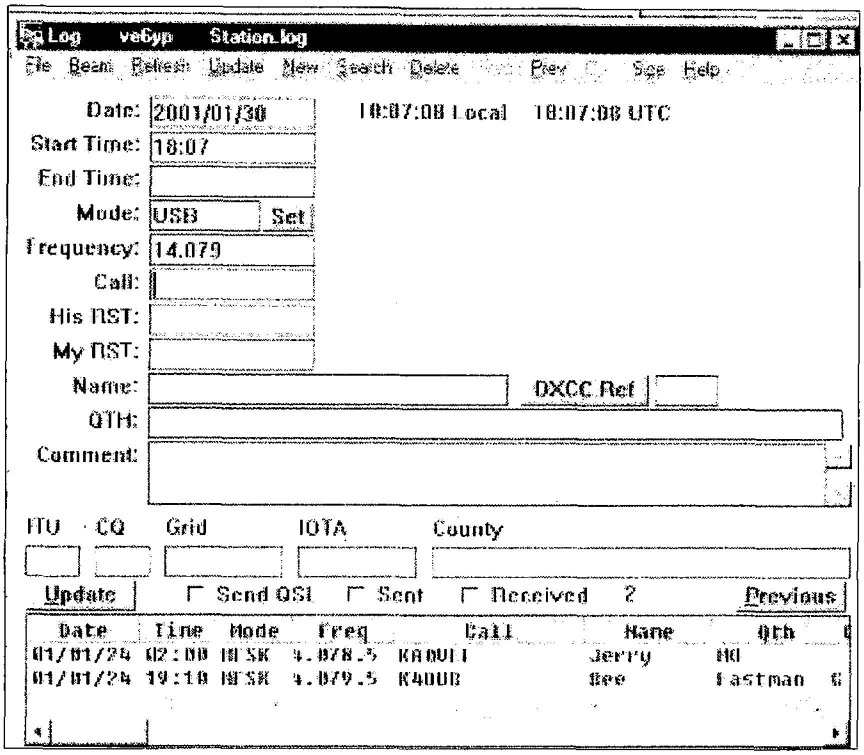

Fig. 2. YPLog screenshot. This is one of several screens available from this piece of shareware. This is an unregistered copy. Logging and radio interface are certainly not crippled. The panel is displaying the radio frequency and mode automatically along with the date and time and a few contacts I made while trying the software. Simple to operate, can be resized to fit with other programs on the monitor, and includes the regular search and printing features.

YPLog

I realized very early that one of the features I would miss most in using the HamScope rather than the Stream software was the logging interface. As many of you are aware, if you have Logger up and running when you click the "Log" button in Stream, the data is exported directly to Logger.

HamScope is compatible with the YPLog program, so I downloaded that and made a great discovery. YPLog is an outstanding piece of shareware. You can use the program from the free download for logging purposes without registering it for the going rate of $50. That makes the program attractive in itself.

I was not able to automate the program very well because I have a conflict of usage of my lone serial port. But I found that the program, operating on its own, interfaces perfectly with the Icom rig. It recognizes and displays frequency and mode and can control these functions and consequently record the information in the log along with the worked station data. (See **Fig. 2**.)

The program is intuitive. It requires very little reference to the in-depth Help file. If you are using the radio interface, the frequency and mode are automatically inserted. Of course, the date and time are automatic as expected. The layout is simple and direct, and users tell me good things about the software.

For my usage, with a small screen area, I display one screen at a time, and pull them up from the Task bar as needed. The ideal is to have the largest monitor the budget will allow and place your various screen displays on the monitor simultaneously. I experimented and found that the YPLog logging screen will resize as you desire for ease of fit. There are at least two other smaller screens you can display with more info from the program should you have the room. (See **Table 1** for download.)

The reason I need an additional serial port is for the PTT to operate with the digital communications programs. This addition is well worth considering for whatever the future of my digital software endeavors. It is possible to get a lot of good service from this old computer, but there seems to be frequent need for upgrade. Unfortunately, I don't see a way to upgrade by purchasing a

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Source for:	Web address (URL):
Mix W Soundcard program for PSK31, RTTY, new modes, MTTY, FSK31, more	http://tav.kiev.ua/~nick/my_ham_soft.htm http://users.nals.com/~jaffejim/mixwpage.htm
MMTTY RTTY soundcard freeware	http://www.geocities.com/mmtty_rtty/
TrueTTY — Sound card RTTY w/ PSK31	www.dxsoft.com/mitrtty.htm
Pasokon SSTV programs & hardware	www.ultranet.com/~sstv/lite.html
PSK31 — Free — and much PSK info	http://aintel.bi.ehu.es/psk31.html
Interface for digital - rigs to computers	www.westmountainradio.com/RIGblaster.htm
Soundcard interface info — includes Alinco	www.packetradio.com/psk31.htm
Interface info for DIY digital hams	www.qsl.net/wm2u/interface.html
WinWarbler info and free download	www.qsl.net/winwarbler/
MFSK — related tech info — how it works	www.qsl.net/zl1bpu/
Throb — New — lots of info	www.lsear.freeserve.co.uk/ www.btinternet.com/~g3vfp/
Download Logger, also Zakanaka	www.geocities.com/kc4elo/
PSKGNR — Front end for PSK31	www.al-williams.com/wd5gnr/pskgnr.htm
Digipan — PSK31 — easy to use — new version 1.6	http://members.home.com/hteller/digipan/
TAPR — Lots of info	www.tapr.org
TNC to radio wiring help	http://freeweb.pdq.net/medcalf/ztx/
ChromaPIX and ChromaSound DSP software	www.siliconpixels.com
Timewave DSP & AEA (prev.) products	www.timewave.com
Auto tuner and other kits	www.ldgelectronics.com
XPWare — TNC software with sample DL	www.goodnet.com/~gjohnson/
RCKRtty Windows program with free DL	http://www.rckrtty.de/
HF serial modem plans & RTTY & Pactor	http://home.att.net/~k7szl/
SV2AGW free Win95 programs	www.raag.org/index1.htm
Source for BayPac BP-2M & APRS	www.tigertronics.com/
Int'l Visual Communication Assn. — nonprofit org. dedicated to SSTV	www.mindspring.com/~sstv/
Hellschreiber & MT63 & MFSK16 (Stream)	http://iz8bly.sysonline.it
HamScope — multimode w/ MFSK16	http://users.mesatop.com/~ghansen/
YPLog shareware log — rig control — free demo	www.nucleus.com/~field/

Table 1. The Chart.

THE DIGITAL PORT

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prepackaged unit. They just don't come out of the box to fit all our ham needs.

Throb

A brand new mode to most of us can be a lot of fun, if for no other reason than to do something we haven't done before. Lionel Sears G3PPT has been working on an innovative nine-tone MFSK system that shows a lot of promise.

I downloaded Throb (version 2.3 as I recall) some time back and had problems getting it to play. I knew other hams were actually using it to communicate, so I assumed some incompatibility in the computer here. Recent results seem to verify that line of thinking.

The current version 2.5 that is available at Lionel's Web page (see **Table 1**) and a few other places on the Internet works absolutely great. (See **Fig. 3**.) Of course, there is one problem. As of this writing, I am sure I have heard fewer than five Throb signals on the air.

In order to have a real, live test run, I engaged the help of Dave W9CGI. After chasing each other by known radio methods for a few hours one Saturday, we were able to conduct a flawless QSO on ten meters, which again, as of this writing, seems to be the band of preference. We hooked up at 28.078 and I was able to see how well this seemingly uncomplicated program tuned and performed.

The print never missed a beat. The mode is designed purposely to overcome weak signal and noisy conditions. Lionel describes his methods to achieve this goal in the accompanying files, and the only downside is that the throughput is a bit slow. This means that the hunt-and-peck typist has plenty of time to get his thoughts through the keyboard with no interruption in the transmitted text. Makes some of us look like good typists after all.

The program supports type ahead and has a few macros available. It takes just a few minutes to master the waterfall. I found it helped to increase (darken) the sensitivity of the waterfall to recognize signals easier. Once you find the other station's signal and center it in your waterfall, solid print seems inevitable.

There is only one problem with version 2.5, and I wrote to Lionel about it. The PTT does not work. I thought perhaps the DTR was not active on transmit, but it is simply a bug he is working on at this time. It will probably be fixed by the time this hits print. In any event, due to the slow throughput, I found there was plenty of time to reach over and manually toggle transmit on the rig. And that was the only problem — A real winner.

And ... speaking of Lionel ... here is a very fertile mind. He has practically perfected this Throb mode and is already headed down the road to another approach to the digital communications. I sighted a reference to a "CWMFSK" program that was supposed to be available from his Web site. There is some little mix-up there, because I went and looked and it wasn't available as yet. But ... again ... by the time you see this ... ?

Hellschreiber

For a long time, I did not take Hellschreiber seriously as a digital communications mode. I tried it a year or two ago and it worked. I was fascinated with what I saw, as it must have existed in a "pre-digital-history" era. Okay, so that is a little harsh. I realize that now, since I have spent a little more time with the IZ8BLY software for Windows.

I am not sure what prompted me, other than a little nudge by Murray Greenman, who has gained recent fame for the instigation of the MFSK16 mode. That, as many of you will recall, was developed also through a mighty effort by Nino IZ8BLY and incorporated in the Stream package, which is a free download (see **Table 1**).

What is of real interest is that there is

more in the Hellschreiber package than plain-vanilla Hell. There are modified modes that deserve particular attention and experimenting. You will find that some of the modes are much superior for marginal path/weak signal conditions.

This is what I found, and how it came about. In addition to the default Feld Hell, there are six other versions available from the mode dropdown menu. My first recent contact with Feld Hell was not a disaster, but the print was very light at my end. I did not know the answer and the ham at the other end would have been quite lucky to have been able to convey the fix (for all I know, he did.)

So I went in search of answers. I signed up on the Hellschreiber reflector. Before I got around to posting a query on the problem, someone posted something like, "and by the way, if you are experiencing light print, turn up the receive audio drive." How simple can it get? I did that little trick.

However, there were no callers out there to answer their CQ nor hear mine after it was all "fixed." But I kept watching for other little clues as to how this mode could be considered so reliable in the long haul.

Another message came by off the reflector stating how much better FM Hell 245 baud handled the weak signal condition. "Very good," I am thinking: Now all I need is a live QSO to try some of these things.

Somebody heard me thinking apparently, because there was a posting that showed up about a quarterly Hell Activity Day that occurs again at the end of April. Very good — we will test these innovations during the flurry of activity that such an event promises.

As luck prevails at this home, I was available for maybe an hour during the specified Activity Period. Dutifully, I tuned around 14.062 and there was a Hell devotee in Nova Scotia, VE1CDD. Excellent copy, but there was suddenly some of that "contest" (?) QRM. I was able to watch JA5TX call me, and the print was interspersed with the VE1 signal. An interesting phenomenon for the uninitiated as I was.

JA5TX, Mitsu, who must be one of the main voices of Hell in Japan asked if I could switch to FM Hell 245 because the print was poor at his end. Another lesson confirmed. I did that and we were able to converse successfully for several go-arounds. And here I am hooked on yet another of these digital modes.

You just have to try it to see for yourself. Some excellent communication over the long haul, under adverse conditions, is being performed using the Hell modes, and most of us are ignoring it.

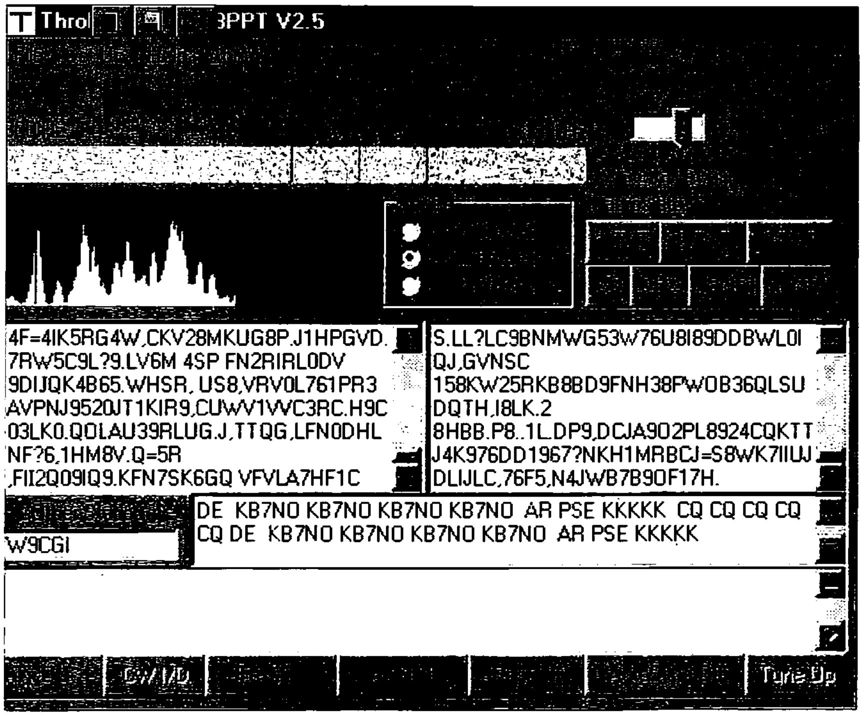

Fig. 3. Throb screenshot. More fun —another new mode! And it is simple to operate. When you find a signal, it will traverse vertically through the waterfall in the top pane. I found it helped to move the Waterfall sensitivity to the right to darken the signal display. Once the signal is centered, the receive text will display in one of the panes that you see containing random characters. One, I understand is for LSB, the other USB. It is very straightforward and easy to use.

Alinco interface

A few days back, there was a posting on a ham reflector that made me think. It was a simple request for interface information, and I thought there would be plenty of answers. I took a quick look at the time and came away a bit puzzled. The interface was to an Alinco radio, and there are very few sites with that radio line covered.

I knew I had seen it somewhere, and when several days had gone by, I did a search and somehow came to familiar territory. A relatively complete source of wiring diagrams is available in the URL defined in The Chart as including "Alinco."

Editorial — What we have

I was talking to a ham the other day about all the different digital modes and all those innovations seemingly just over the horizon. I was remarking how I can't keep up and how it just doesn't seem possible that a ham of the current vintage could have an excuse (or the time) to go sit down in front of the television these days.

Speaking of the TV, I noticed a little blurb about some contract negotiations were going poorly and how, perhaps before this reaches you, the TV script writers will strike. Some journalist was remarking how "things would only get worse, etc." Perhaps there are some old Milton Berle or Ed Sullivan shows that could be rerun so that we could give today's viewers a real treat for their money. I watch so little of the current product of weird imagination that I would fare poorly at any trivia test on the subject. But enough of that, back to the serious business of ham radio. At least you and I have an alternative.

Just about when I had really given up on the upcoming crop of kids, I was talking to a ham who had bought his grandson a crystal set kit. He was telling me how the boy's eyes lit up when he heard it play the local AM station. Reminded me of a time when I was about that kid's age. (Okay, so all there was was AM)

Things don't really change just because there are hand-held game machines and the Internet for distraction. Science is still there, just waiting to be discovered — sometimes re-discovered is the correct approach. How much fun that is comes in the presentation of what can be done with simple components.

We still have, in ham radio, one of the close links to cutting-edge science and it is

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SUNSAT Sunset

With so many active amateur-radio satellites in the sky, the loss of one doesn't seem like a significant event, but it is. We are reminded that hamsats are a limited resource, and they do not last forever. In January, we lost one of the best LEO (Low Earth Orbit) birds.

On January 19, 2001, the ground station at the Electronic Systems Laboratory at Stellenbosch University in South Africa lost communications with SUNSAT-OSCAR-35. While there is always hope that communications can be restored, the university researchers and hams have announced that the only contact they expect to achieve is an occasional visual sighting via telescope. In a joint announcement from Professors Jan de Plessis and Arnold Schoonwinkel in early February, possible explanations for the loss of communications were proposed along with a synopsis of the recovery attempts.

Three possible scenarios have been proposed for the cause of failure. One is a simultaneous multipoint failure due to simple battery failure, solar-cell malfunction, and problems in the power regulation system. Next on the list is the possibility of a ruptured battery or a main-power-system diode failure. Finally, there is always the chance that there was a collision with an external object, causing major damage and leading to catastrophic events.

Many hamsats have outlived their computers and battery systems. AMSAT-OSCAR-10 is a perfect example. It is still in orbit today, 17 years after launch, providing communications via its Mode "B" (70 cm up and two meters down) transponder. The computer succumbed to radiation damage over a decade ago and the batteries no longer work, but the solar panels still provide power for the default transponder. In the case of SO-35, something drastic happened.

SO-35's active time in orbit lasted nearly two years. In the first year, solar illumination was optimum. The eclipse periods, during which SUNSAT was shadowed by the earth, were not a problem for the batteries and provided some periods of cooling. During its second year in space the satellite experienced five months of continuous illumination. This caused overheating and battery overcharging. The ground control station was forced to reorient the satellite in an attempt to counter these solar effects. When eclipsing resumed, it was noticed that the batteries were experiencing discharge problems during dark periods. The battery charge levels were cycled a number of times to diminish the effects of NiCd memory problems. Just before radio contact stopped on January 19th, telemetry indicated that all systems were working well. It was an unexpected event.

Controllers in South Africa used all possible combinations of the telecommand systems in their attempts to regain communications with SO-35. All failed. The ground station was tested with other hamsats for both uplink and downlink operations. No problems were noted with the terrestrial gear. Nothing was heard from the satellite, even during passes where the satellite was completely illuminated.

Photo A. John WA5WOD and our hunting guide Abel get the horses ready.

SUNSAT accomplishments

All of the original SUNSAT program goals were exceeded during its two-year lifetime. They included: providing new standards for amateur-radio satellite operation; demonstrating higher-resolution imagery from space than previously used on small satellites; stimulating graduate-level research development; fostering international science and engineering ties; and, finally, promoting educational efforts and technology in South African schools.

In the amateur-radio arena, hams were given a new and exciting analog/digital satellite. The "bent pipe" FM up-and-down voice transponder worked extremely well. The most popular voice mode was "B" with its 70-cm uplink and two-meter downlink. Even the cheapest HT or scanner could hear

Photo B. Andy W5ACM making contacts from "Base Camp One" at 10,000 feet (Grid = DM75ET, NE of Santa Fe, NM) via UO-14.

Photo C. Amazing — The Palm VII is getting Web access and E-mail from deep in the "back country" of New Mexico!

the signals from SO-35, and the uplink was usually not as crowded as the other FM satellites, since the satellites schedule changed often due to university experiments.

For digital experimenters, the APRS (Automatic Position Reporting System) at 1200 or 9600 baud was intriguing. It was quite easy to set up a mobile rig to beacon live GPS (Global Positioning System) data through SUNSAT to other stations within the downlink footprint. This South African academic/amateur satellite proved an excellent proof-of-concept test bed for APRS-via-hamsat endeavors. You can find out more about SO-35's achievements via the SUNSAT Web site at [http://sunsat.ee.sun.ac.za].

Hunting for Hamsats

The loss of the FM repeater on SO-35 is significant, but we still have UoSAT-OSCAR-14 and AMRAD-OSCAR-27. With their two-meter uplink and 70-cm downlink Mode "J" transponders, lots of easy contacts are possible with simple gear.

Earlier last winter, I went hunting for elk with Bill WA5VQH and John WA5WOD in the mountains of New Mexico. Our hunting site was so remote that the only way in was to hike or pack in on horseback. We did both in our quest for big game. Bill provided the food, surplus MREs (Meals Ready to Eat). John brought the weapons, and we all brought plenty of cold-weather clothing. Our guide, Abel, supplied the horses.

I brought radios, antennas, GPS receivers, and my Palm VII PDA. In addition to its use as a satellite tracker and route mapper, the Palm VII also provided excellent E-mail communications from the back country. All of these radio toys only took up as much space as my digital camera and camcorder. Our trip was more than just a typical hunting expedition — it was also a great opportunity to go camping, experience some beautiful surroundings, experiment with ham radio, and visit.

It was evident that it would not be possible to catch as many satellite passes on this trip as we did on the family cruise to ports in Mexico during the summer of 2000. There were chores to do, and you can't ride a horse up the side of a mountain while attempting to tune a radio and orient an antenna for UO-14 or AO-27 contacts. Thus, most on-the-air activity was accomplished while in camp or back at the cabin.

The satellite radio was my Alinco DJ-580T with large 12 VDC battery packs for five watts output on 70cm. The antenna was the Pryme AL-800 telescoping dual-band whip. It collapses to 9.5" and telescopes out to 34". Since it is rigid, it is a bit unwieldy to use around people and trees, but makes up for that with its gain over shorter antennas. I also brought the usual earbuds and hand microphone to allow for easy full-duplex voice operation.

A few dozen contacts were made from the mountains northeast of Santa Fe, NM, with stations ranging from Canada to Mexico. Many folks got us for a new grid square and we had a lot of fun doing it. The GPS receivers helped us keep track of our location in the mountains and allowed me to ascertain our grid square from the cabin, base camp, and final hunting position. The Palm VII provided easy E-mail to friends and family that don't chase hamsats, and also gave us weather updates via its "Web clipping" feature using [weather.com]. Oh, yes: We got our elk!

New CD offering from AMSAT

At the AMSAT meeting last year, Russ Tillman K5NRK (AMSAT VP of Publications) proposed that AMSAT produce a CD containing back issues of *The AMSAT Journal*. Russ, volunteers, and contractors have worked to scan in six years of *The Journal* and produce a two-CD set. Adobe Acrobat was used to create PDF (Portable Document Format) files.

The AMSAT Journal typically runs about 32 pages and is printed bi-monthly for current paid AMSAT-NA members. The publication is printed in black and white on quality paper, but over the years has not been available in any electronic form.

When one of the two CDs is placed in the computer, the Autorun function starts up Acrobat Reader from the CD and displays the CD contents via a custom title page. Browsing through the back issues is simply a matter of point and click.

Continued on page 58

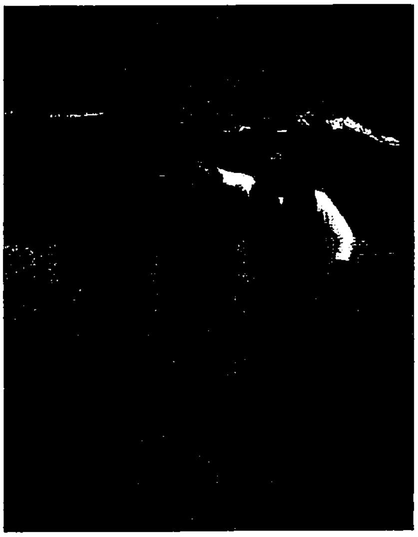

Photo D. Andy W5ACM, John WA5WOD, and Bill WA5VQH celebrate a successful elk and hamsat hunt atop Hamilton Mesa in New Mexico.

THE DX FORUM

Dr. Rick Olsen N6NR
Western Washington DX Club
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Issaquah WA 98027-0538
[n6nr@arrl.net]

Changes in the Wind

OK. I heard ya. It's true. The relaxation of Morse code requirements has brought many newcomers to DXing. Many of you have said that the old-timers are turning a cold shoulder to you, and are reluctant to show you the ropes. Well, we're not going to do that here at 73 Magazine. The beginner is welcome, and in the months to come you will see more features devoted to those who have just discovered the joys of DXing on the HF bands (and elsewhere, for that matter).

That's not all that is going to be different here on the pages of *73*. I have had numerous discussions with fellow DXers, as well as *73* staff, concerning the right venue for providing our DX-enthusiast readers with information and features that will serve them in the months and years ahead. This discussion actually began back when we decided to bring a DX column back to our readers. Wayne had asserted correctly that the DX community "doesn't need another DX *news* column." There are a number of excellent columns being written today. Consider as well that nearly every DXer has access to the Internet these days, and that there are numerous bulletin services that are available via that medium. Consequently, DXers have almost real-time access to newsworthy items concerning DXpeditions and the like. We in the printed media are shackled by production cycles and editorial lead-times. When it comes to providing time-critical information, it is impossible to compete with the immediacy of on-line electronic media.

So what does that mean to the editor of the DX Forum? The message that I keep hearing from those who have graciously taken the time to correspond with me on this issue is that *73*'s coverage of DX should focus on three things:

1. High-quality printed reference and "how to" material for the great number of newcomers to DXing.
2. In-depth coverage of DXpeditions.
3. A more comprehensive approach to the human interest component of DXing.

In response to these recommendations I, and others at *73*, have decided that I will (a) focus my attention away from a monthly column; (b) devote my energies toward detailed feature articles, equipment reviews that approach the introduction of new equipment from an operational, rather than a purely technical perspective; and (c) encourage and mentor other authors to write about DXing. The DX Forum will become more of a quarterly feature in *73*, focusing entirely on the human element of our passion for chasing DX. Our readers will begin to see more in-depth articles on the world of DX from a number of authors. Starting as soon as possible, there will be many more new equipment review articles that highlight what you can expect from the fancy new toys that are hitting the market.

Oh, and as far as the newsworthy stuff is concerned, and I know I'm going to upset a few folks by saying this (and don't mean to), the best source of time-sensitive information these days is on-air nets, your local radio club, and on-line newsletters. In fact, I'm going to be so bold as to make a strong recommendation that you look into subscribing to Bernie McClenny's "Daily DX" bulletin service. He has cultivated what I think is just about the best network of information sources, and is devoted to keeping us up to date on a daily basis.

So there you have it. Let me know what you think of these sweeping changes. Yogi Berra once said that, "You don't know what you don't know." That certainly applies to me.

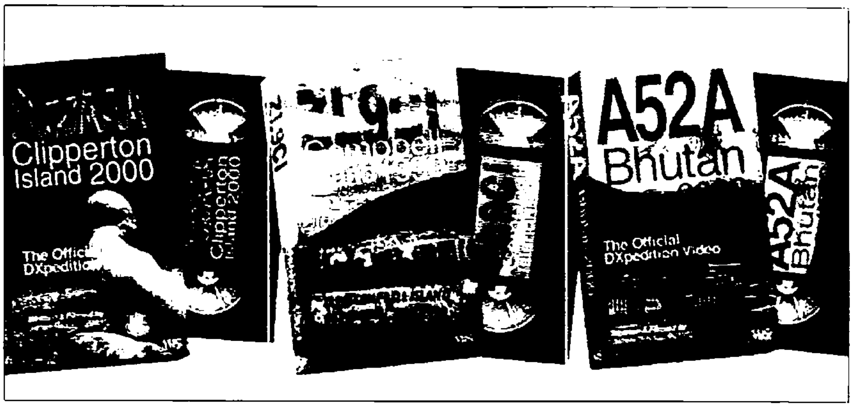

***Photo A.** New videos available from 9V1YC.*

New videos available from 9V1YC

If you are wondering about what life is like on the other end of the pileup, there are some excellent videos that are now available. One of my very favorite operators is Jim 9V1YC. He has certainly gotten around, as it were, and has produced some videos that provide a glimpse into the world of DX from the DXpeditioner's point of view. His latest offering is a chronicle of the A52A DXpedition that took place in 2000. Jim's tapes are high quality, and very informative.

Here's a little note from Jim:

Hi, everyone,

Apologies for the bandwidth, but since this is DX related and I've been bombarded

Photo B. This is what I stare at when I'm chasing the big ones.

Photo C. Here is my "dB enhancer," a Henry 2k Classic X. I finally broke down and agreed with K7SS that life is indeed too short for QRP.

with E-mail asking me "When is it gonna be ready?!", I figured this is the easiest way to hit everyone at once without going nuts searching my "in-box."

After a long wait, I'm happy to report that the A52A Bhutan video is now finished. If you've ever wondered what Bhutan is really like from the inside, or what it's like to be behind an opening-day pileup at the #2 most-wanted, then you might be interested in this one. Lots more pileups this time, but also plenty of scenery, people, music, and background info on this absolutely beautiful country. 60 minutes of fun. (And your QSO with A52A just might be in there, too.)

My home page has more info at [http://home.pacific.net.sg/~jamesb].

I hope you enjoy it.

73,

James 9V1YC

He provides them in both NTSC and PAL format. His price is $15 US, plus another $5 each for shipping. You may obtain them at the following:

James Brooks 9V1YC
70A, Duxton Road,
Singapore 089529
[http://home1.pacific.net.sg/~jamesb/hw2buy.htm]
[jamesb@pacific.net.sg]

And now the news ... I just got this from Bernie W3UR:

DXCC Announces New 17-Meter Award

DXCC is pleased to announce the addition of a 17 Meter Single Band DXCC award. Applications for this award will be accepted beginning January 2, 2001. 17 Meter DXCC certificates will be dated but not numbered. 17 meter credits will also count toward the DeSoto Cup competition for the year 2001.

If you do not know what credits you have on 17 meters, you may contact DXCC for an update prior to applying. This will help avoid duplicates and additional costs. If you have Web access and can handle Adobe (.pdf) files, contact DXCC at [dxcc@arrl.org] for a copy of your record. If you do not have Web access, please send a note to DXCC along with $1.50 for postage or an SASE with $1.50 in postage. For further information, please contact DXCC at [dxcc@arrl.org].

Hamshack tours

Nobody believes me when I tell them that there are no towers at my QTH, and that I am not using some huge piece of aluminum overcast to punch pileups. So just for fun I thought I would employ editorial license, and send along a few photos from my own shack. Notice that my FT-1000D has a new

Continued on page 58

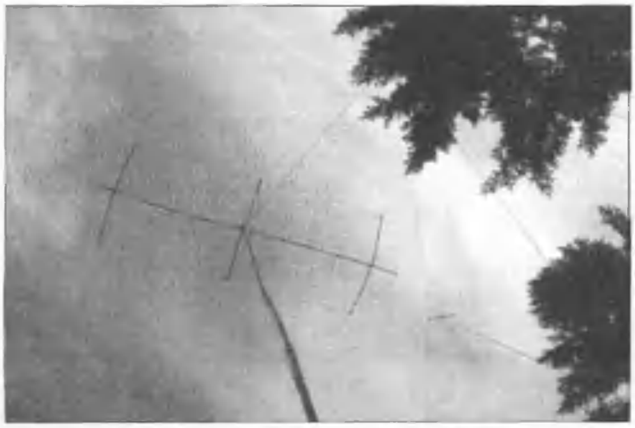

Photo D. Here is one of my antlers. It is a 2-element beam made out of wire, PVC, and twine. It is hung from a rope catenary, and rotated from the ground. I will have an article on this thing in an upcoming issue of 73.

Photo E. Remember last time when I said I would take some photos of the goodies I got from the Central Arizona DX Association? Well, here is a shot of the really nice coffee mugs I got. I also received a very nice gold-engraved pen, and a very handy mouse pad, which is in use as I prepare this month's column. Thanks again to my old friends at CADXA for the wonderful goodies.

On the Go

Mobile, Portable and Emergency Operation

Steve Nowak KE8YN/0
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Omaha NE 68130-1529
[ke8yn@netzero.net]

Springtime SkyWarn

As springtime approaches, we amateur radio operators find that we can once again provide some very worthwhile services to our communities. At this time of year, one of the most important services we can provide is through the SkyWarn program. SkyWarn provides eyes in the field for the National Weather Service during times of threatening weather. While amateur radio is a very important player in disaster recovery, SkyWarn provides a unique opportunity to provide service to help minimize damage, rather than to recover from it.

SkyWarn provides trained storm spotters. Unlike in the movie *Twister* (one of my personal favorites), we are not storm chasers, but spotting is a critically important service that should not be underrated. Essentially, SkyWarn spotters are able to provide additional information for meteorologists who are reading the data from their various instruments, remote stations, radar, etc. In other words, we provide the last piece of the puzzle to allow the meteorologists to better predict what is going to happen. More importantly, spotters can provide accurate and useful information coordinated through a network. This network ensures that the information will be provided in a logical and convenient manner to the meteorologists. This is one of the advantages of a network over having individuals contact the Weather Service via cellular telephone.

What are the elements of a successful SkyWarn operation? Since SkyWarn programs are managed locally, each may be slightly different, but there are certain common elements that contribute to the overall success of the effort.

1. SkyWarn operators are trained by the National Weather Service. There are several areas of training that are important to ensure the program's success. Although not every SkyWarn operator will function as a spotter, if at all possible, every operator should complete the SkyWarn spotter training program. This is usually conducted by National Weather Service meteorologists and is quite interesting for anyone with even a remote curiosity about weather. There are a number of observable phenomena covered in the program that are not intuitively obvious to everyone. The course is commonly taught in two sessions, with the second more advanced session building on the first. I cannot overemphasize how valuable and essential this training is. Besides, if you're looking for a relevant program for the local club meeting, here's one way to fill an open slot or two!

There are some key players in the SkyWarn team who may not be trained in storm spotting. Some of the most effective net control operators I've seen have been physically challenged. A blind ham I worked with could keep station locations and reports more accurately in his mind than I ever could with pen, paper, computer, etc. He was probably the best net control I ever saw.

2. SkyWarn operators are trained in net operations. It is important to know precisely what to say and when. It is more important to know when to say absolutely nothing. As hams we love to talk, but "fair weather" reports telling the entire net that nothing is happening at a particular location are counterproductive. They distract people and someone with relevant information must wait until the frequency is clear to transmit his report. SkyWarn nets normally should be operated as a directed net with all communications directed to the net control, and it's best if everyone is accustomed to this type of operation.

3. SkyWarn operators know how to communicate their information. The way we hams talk and the way meteorologists talk are not the same. If NWS is our customer, we need to provide the information they need in the manner they need it, not in the way we normally would present it. Key items they need to know about include lightning, abnormally heavy rain, high winds, hail, and rotational patterns.

• Lightning — Meteorologists need to know if it's cloud-to-cloud or cloud-to-ground. They also may need to know its frequency, either by number of strikes per minute or the average delay from one lightning flash to the next.

• Rain — It is best if we can describe rainfall accurately. If you have a rain gauge, then state that it is so many inches per unit of time and that you measured the rain. If not, you may describe when a street floods, or if the sewers are overflowing. Describe what you see rather than estimate.

• Winds — Unless you have a wind gauge, it's normally best to provide a factual description. This may include how far trees are moving and the size of the trees. Another good indicator is the direction of rain. If all the rain appears to be horizontal, that gives the meteorologists an idea as to wind speed.

• Hail — Hail is a very important indicator of vertical development of a storm. Generally, the more vertical the development, the more powerful the storm. The best description possible is obtained by actually measuring the hailstone size. If you can't, then describe it in relationship to a coin. Never describe hail as the size of a marble! There are marbles of all sizes, so this description is not only worthless, but a good way to frustrate your friendly neighborhood meteorologist.

• Rotational patterns — These, of course, are critical if conditions are conducive to the formation of tornadoes, and tornadoes can be a secondary event of other weather patterns such as hurricanes. Not all rotations are tornadoes, of course, as there are waterspouts and

Continued on page 58

Calendar Events

Listings are free of charge as space permits. Please send us your Calendar Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the June issue, we should receive it by April 30. Provide a clear, concise summary of the essential details about your Calendar Event.

APRIL 7

LONDONDERRY, NH The Interstate Repeater Society will hold their Spring Hamtest and Flea Market on Saturday, April 7th, at the Lions Club Hall on Mammoth Rd., RT 128, in Londonderry NH. Directions: I-93 to Exit 4. Go west on RT 102. Go right at lights just after Dunkin' Donuts. The hall is one mile on the right. Vendor setup 6 a.m.–8 a.m. Admission fee $10 at 6 a.m., $3 at 8 a.m. For table reservations, please call *Paul at (603) 883-3308;* or E-mail to *[K1LLX @juno.com]*. VE exams 9 a.m. to noon. Reservations suggested. For more into call *Bill at (603) 424-2857*, or E-mail to *[BILLS@ AA1OC.org]*.

APRIL 8

RALEIGH, NC The Raleigh ARS will host its 29th Hamfest and Computer Fair in the Jim Graham Bldg., NCS Fairgrounds, Sunday, April 8th, 8 a.m.–4 p.m. Wheelchair access. ARRL, MARS, ARES and NTS meetings will be featured. Pre-register for $5; $6 at the door. All activities inside. Tables and booths available. Free parking. RVs are welcome. There will be a hospitality party Saturday night. If you are interested in VE exams, call *W4VFJ at (919) 556-8551*. Contact *Hank Montgomery K4HM, 5045 Alianbrooke Ln., Fuquay-Varina NC 27526* for pre-registration and dealer info. Tel. *(919) 577-1254; E-mail [k4hm@arrl.net]*.

STOUGHTON, WI The Madison Area Repeater Assn. will host the "Madison Swapfest" on April 8th at Mandt Community Center, Stoughton Junior Fair Grounds, South Fourth St., Stoughton WI. Free parking. Doors open at 8 a.m. Talk-in on 147.15. Tickets $4 in advance or $5 at the door. Tables $12–$15 each. Contact *Madison Area Repeater Assn., P.O. Box 8890, Madison WI 53708-8890. Tel. (608) 245-8890. Web site [http://www.qsl.net/ mara/]*.

APRIL 21

WEST ORANGE, NJ The Roseland Radio Club will present an Amateur Radio, Computer, SWLer, Electronic Hobbyist Hamfest, Saturday, April 21st, 8:30 a.m.–1 p.m. at the West Orange High School, 600 Pleasant Valley Way, West Orange NJ. Talk-in on W2QR rptr. system: 146.415(+1.0) 85.4T, 224.480(-1.6) no tone, 447.875(-5.0) 156.7T, and 146.520 simplex. Plenty of free parking. Ground level access. Admission $5 at the door. No advanced tickets. XYL/children under 12 free with regular admission. Advanced tables $12 for the first, $9 each additional; $15 for first table, $12 for each additional at the door. $2 for limited # with electric. Reservation deadline is April 11th. After that, first come first served. Sellers admitted at 6:30 a.m. Special vendor parking lot. VE exams courtesy of Nutley ARC. For more details contact *Jim Howe N2TDI or Liz Howe N2WGH, (973) 402-6066; E-mail [jimn2tdi@att.net]*. Club Web page is at *[www.qsl.net/k2gq]*.

APRIL 29

ARTHUR, IL The Moultrie ARK invites you to their 39th annual Hamfest. The event will be held at the Moultrie/Douglas County Fair Grounds on the south side of Arthur, just off Illinois Rte. 133, behind the school. Hours are 8 a.m.–1 p.m. Talk-in on 146.055/.655 and 449.275/444.275. Admission is $5 per person over the age of 14 years. Plenty of indoor space is available, but there are a limited number of tables. Tables are $10 each, paid in advance. To reserve tables, or for more info, contact *M.A.R.K, P.O. Box 91, Lovington IL 61937; or tel. days (217) 543-2178; eves. (217) 873-5287.*

CANFIELD, OH The 20/9 Amateur Radio Club, Inc., of Youngstown OH, will present its 17th Annual Hamfest, Sunday, April 29th, at Mahoning County Career and Technical Center (formerly J.V.S.), 7300 N. Palmyra Rd., Canfield OH, from 8 a.m.–2 p.m. Admission $5, children under 12 free with an adult. Mobile check-ins and directions until Noon on 147.315 and 443.225, with 145.275 for backup. Free parking. Handicap facilities available. Outdoor flea market space, $2 per 10 ft. section. Dealer/ Flea market setup at 6:30 a.m. Inside tables, $10 per table, gate admission NOT included. Inside tables guaranteed until 9 a.m. with reservation fee in advance, others first come first served. Dealers, send registration with an SASE and check or m.o. payable to *20/9 Amateur Radio Cub, Inc., 55 S. Whitney Ave., Youngstown OH 44509*. Reservation deadline is April 15th. For more info, contact *Don Stoddard N8LNE, Chairman, 55 S. Whitney Ave., Youngstown OH 44509; tel. (330) 793-7072. E-mail [N8LNE1@juno.com]*; or *Rich Hamaker, Co-Chairman, 4939 E. Radio Rd., Youngstown OH 44515, tel. (330) 792-4019.* Uniformed and plainclothes security will be present. Alcoholic beverages, firearms, and questionable or demoralizing materials, are not permitted on school property.

MAY 5

CADILLAC, MI The Wexaukee ARC will hold their 39th Annual Amateur Radio and Computer Swap Meet on Saturday, May 5th, from 8 a.m.–12 p.m. at the Cadillac Junior High School in Cadillac MI. Talk-in on 146.980/ K8CAD rptr. Free parking. Admission is $5, tables $8 per 8 ft. table. VE exams at 10:30 a.m., by pre-registration only; contact *Alton NU8L (231) 862-3774* or E-mail *[amcconnell3 @hotmail.com]*. For more info please write to *The Wexaukee ARC, P.O. Box 163, Cadillac MI 49601.*

CEDARBURG, WI The Ozaukee Radio Club will sponsor its 23rd Annual Cedarburg Swapfest, 8 a.m.–1 p.m. at the Circle-B Recreation Center, Hwy. 60 and County I (located 20 miles north of Milwaukee, west of Grafton). Admission is $4, both in advance and at the door. 4 ft. tables are $5 each (limited power available on request). Seller's setup 6:30 a.m. VE exams start at 9 a.m. Talk-in on 146.37/ .97 and 146.52. For tickets, table reservations, maps, or additional info, send an SASE to *Gene Szudrowitz KB9VJP, ORC Swapfest Chairman, W55 N865 Cedar Ridge Dr., Cedarburg WI 53012. Tel. (262) 377-6792;* or *Skip Douglas at (262) 284-3271.*

MAY 5–6

ABILENE, TX The Key City ARC will sponsor the ARRL West Texas Section Convention and 16th annual Hamfest at the Abilene Civic Center from 8 a.m.–5 p.m. Saturday, and from 9 a.m.–2 p.m. Sunday. Free parking. VE exams. Wheelchair access. Limited RV parking for a nominal fee. Tables $7 each. Pre-registration $7 (must be received by April 30th), $8 at the door. Talk-in on 146.160/.760. For reservations and info contact *Peg Richard KA4UPA, 1442 Lakeside Dr., Abilene TX 79602. Tel. (915) 672-8889; E-mail [ka4upa@arrl.net]*.

SPECIAL EVENTS, ETC.

APRIL 21–22

RACHEL, NV The Silverdust ARA of Nevada (N7A) will operate from Rachel NV 2000Z April

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Joe Moell P.E. KØOV
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Fullerton CA 92837
[Homingin@aol.com]
[http://www.homingin.com]

Foxhunting, from Melbourne to Nottingham

Today's newspaper has yet another article about how Americans love their cars, vans, and SUVs. Even two-dollar-a-gallon gasoline hasn't slowed us down. Ham operators have combined their love of radios and cars for decades. They fill their vehicles with gear so they can chat, work DX, and keep track of one another with APRS as they roll along.

Nobody loves to combine driving and ham radio more than mobile hidden transmitter hunters. A T-hunt (or mobile foxhunt as it's sometimes called) usually means an afternoon or evening in a vehicle full of radio direction finding (RDF) gear. trying to find one or more radio beacons that have been put in unlikely places by fellow hams. Some in southern California aren't content with such a simple format. Their "All-Day" (better named All-Weekend) hunts start on Saturday morning and can last well into Sunday.

Regular "Homing In" readers know all of this, but may not realize that mobile T-hunting is a favorite sport in some places outside of North America, too. I have corresponded with Japanese, Italian, and Mexican hams who like to do it and to talk about it. But for gung-ho enthusiasm and competitiveness, it's hard to surpass hams who call their car hood the "bonnet" and car trunk the "boot."

G'day, let's hunt!

If you're ever in Melbourne, Australia, on Friday evening, find out if there will be a radio foxhunt that night. If you participate, you're virtually guaranteed an unusual adventure. Before suppertime (which may be at midnight), you may have to find a dozen transmitters. Some will be plainly visible from your vehicle, but expect several of them to be cleverly camouflaged.

Team leaders draw lots for positions in the lineup of cars at the start point. Then the first fox drives off to plant the first transmitter. The hunters (called "hounds" Down Under) take off about 10 minutes later.

Odometer mileage means nothing on a Melbourne hunt. Your team, which typically includes as many hams as the vehicle will hold, has to be first to find each fox for best score. As soon as you find one, it's off to find the next one, and so on.

To save time on hunts where the fox is not right out on the road, back-seat team members jump out and take off on foot with hand-held "sniffers" when they think they are within rapid hiking distance of the fox. This practice is called "dropping runners." The front-seat hunters then continue, trying to drive closer if they can.

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Photo A. *The VK3GMZ team hunts on two meters with both a horizontally polarized beam and a modified marine doppler array. (Photo courtesy of Mark Diggins VK3JMD)*

Photo B. *From the passenger seat, VK3CHR handles RDF gear for the VK3UT RDF team. Homebuilt RDF setups are the norm in Melbourne. (Photo courtesy of VK3JMD)*

Photo C. John Wood GØPSI (left) and Dave Bullock G6UWO proudly display their ARCON foxhunting trophy. (Photo courtesy of Dave Bullock G6UWO)

Homing In

continued from page 51

The January 2001 Melbourne hunt was a good example of cunning and high tech. Here are some excerpts from the VK3YDF hiding team's report: "Five teams of hounds set off from a shopping center car park in Boronia. Bruce from the VK3YQN team was first to find the first fox hidden inside a blackberry bush between Burwood highway and the train line in Ferntree Gully.

"The second fox was behind a school in Ferny Creek. It was near the intersection of two 'roads' behind the school. Although marked on the map, they actually didn't exist at all. Several teams found their access blocked by rather large trees and impenetrable bush. Others found that one of the so-called 'roads' had a walking track near it, which provided easy access to the fox. The third signal led to a rail siding west of Upwey rail station. The fox had buried himself under foliage just above a concrete wall.

"Next was the main event for the evening, a two-hour multileg hunt. Eight transmitters were running on the same frequency. A number of different rates of transmission were used, ranging from continuous through various levels of intermittent. Each fox had a point score that increased the more intermittent the transmission.

Photo D. John and Dave's foxhunting vehicle with its motorized beam at a hilltop test site. (Photo courtesy of G6UWO)

"All eight foxes were programmed to switch on at 9:30 p.m. and off at 11:30 p.m. Each hound was given two keys consisting of a 6.5mm plug containing a pre-programmed microprocessor. When plugged into a socket on the fox, the code transmitted from the key recorded the first time that team's plug was plugged in, and also disabled the transmitter for 10 seconds. This gave a chance for the rest of the team to take bearings on other close-by foxes during the time the transmitter was disabled. Some foxes were sitting next to or at the end of roads, but were not visited by any hounds. On the other hand, some foxes were hidden on 'roads' that didn't exist.

"The supper hunt started at 11:30 p.m. with two foxes. Steve VK3YLE was parked in his car just above a disused quarry in Ferntree Gully. Adam VK3YDF was just below the same quarry operating on a handheld. While there was a very easy access to Steve's location, most teams chose another very steep and bumpy road to either arrive or depart from his location. Adam, who was barely 500 meters away from Steve, was quite surprised to see some teams drive within 50 meters of his location only to do a U-turn and head back up to Steve before trying again. The signal was apparently just not strong enough to be there!"

When I visited Down Under some years ago, most of the gear in almost every hamshack was home-built. For RDF at least, Aussies' love of do-it-yourself continues. Each team has developed its own creative collection of mobile hunting gear. Some setups are quite advanced, featuring motorized directional antennas, computers, and cathode-ray tube displays (**Photos A** and **B**).

"Sniffers" for on-foot hunting usually consist of a sturdy three-element yagi and a receiver with built-in attenuation. Some hunters replace the receiver's analog S-meter with a voltage-controlled audio oscillator and speaker. The pitch of the oscillator's tone goes up and down in proportion to the signal level. They call them "whoopee sniffers."

RDF intrigue in Merry Olde England

On the other side of the world, hams with similar accents hold similar transmitter hunts. Dave Bullock G6UWO of Nottingham, England, E-mailed to tell about his organization, the Amateur Radio Club of Nottingham. ARCON sponsors foxhunts throughout the year on the third Thursday of each month, from April through October.

As with the Australians, the ARCON fox is chosen by lot. Hunters' vehicles can

have as many people inside as they want. G6UWO hunts with John Wood GØPSI (**Photo C**). In the club, there are some individual hunters and some cars that usually have four occupants.

The fox gives a one-minute transmission every 5 minutes, starting at 7:30 p.m. At 9:30, the fox location is revealed, along with the location of the pub where the hunters will then gather. The fox must hide within a 20-kilometer radius of the starting point and must be within 150 meters of a point accessible by a "normal family salon car."

Rules state that the fox may not be on private land, but an exception is made for private places normally used by the public. "Parking lots are OK," Dave says. "But there are many areas in Nottinghamshire that are privately owned, such as woods, country lanes leading to farms, and so forth. Some of these are ideal hiding places, but the owners get upset when hoards of people brandishing antennas come swarming over their property!"

Unlike the Aussies, these Brits have only one fox to find on a hunt night. That gives the fox team a big incentive to make that fox special. Automatic foxboxes are prohibited, so it's up to the ingenuity of the fox team to find a clever way to conceal both transmitter and operator. G6UWO's examples of recent hunts include these:

1. The fox dressed up as a fisherman by a river in the midst of a fishing competition. The transmitter was in his fishing basket-seat and the antenna was disguised as a fishing rod. Dave's comment: "Fishermen can be very serious!"

2. The fox dressed in "biker" gear in a Public House garden, sitting with other tough looking "bikers," all drinking. Dave's comment: "Extremely amusing, as hunters were very wary of approaching any of the leather-clad groups!"

3. The fox transmitter was under a major road intersection that had several levels of roads all crossing each other in a "spaghetti junction" type of layout. He was running 400 watts to a vertical antenna and gave an S9 signal 50 miles away. Dave's comment: "This really sorted those out with poor attenuators and leaky receivers. He actually melted the first antenna he tried!"

There's another example involving a "campervan" near other campers, with curtains drawn. Since this column is G-rated, you'll have to ask Dave about that one yourself!

A laptop in the nettles

I asked, "How can the fox transmit without his voice being heard by close-in hunters?" Dave replied, "He speaks very quietly! The hunters tend to arrive in ones and twos, so hearing the fox doesn't give much of an advantage. Usually, when you are able to physically hear him you have eyeball contact anyway. It is mainly the tricky hiding places with strange radiation reflections that tend to slow the hunters down."

Photo E. Dave adjusts the controls on the CRT readout of their "secret weapon." (Photo courtesy of G6UWO)

G6UWO went on to tell of a case where the rules were bent a bit. "The fox hid in tall stinging nettles at night under a camouflage-colored umbrella. His antenna was hidden in a tree directly under power lines to give a weird radiation pattern. He used a laptop and its sound card to time transmissions and play the audio. He put special sound effect backgrounds on his transmission to make him sound much nearer to a local main highway than he really was. It was pitch-black and pouring rain. Everyone was in the area, yet no one found him!"

Rules require vertical antenna polarization, nonvariable power of not less than 1 watt, and fixed antenna position. "This prohibits foxes from just using a handie-talkie

Continued on page 58

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Remembering the "Drift-o-matic"

The HW-9 is a great QRP rig. Although it never reached the cult status of the HW-8, there are plenty of them still on the air. They have a good number of features and produce more than enough power to work the world.

And then there's the HW-9's forgotten half-brother: the HW-99. At first, I was not going to even talk much about this guy. The HW-99 is a Novice CW-only transceiver that operates on the 80, 40, 15, and 10 meter bands. It is really not a QRP radio, since the HW-99 will easily produce up to 50 watts output into a 50-ohm load. Most people looked at the HW-99 and determined it was featureless, expensive, and drifty. And they were right on all three counts. The HW-99 lasted only about a year and a half before Heathkit dropped it from their line. The HW-99 is housed in the same type of clamshell housing and sports the same two-tone brown color scheme.

The HW-99, a closer look

Running up to 50 watts input, the HW-99 can be adjusted down to QRP levels with a front panel drive control. I can get my HW-99 down to almost one watt with the drive control fully counterclockwise.

For some strange reason, I suspect cost savings, the HW-99's final transistors operate from a plus 30-volt VCC line. Hence, you can't add on an external 12-volt supply to operate the HW-99 in the field. For this reason, the HW-99 has its own built-in power supply. In fact, the butt end of the power transformer is exposed on the rear apron of the radio. It almost looks like the transformer was added on at the last moment, as the entire rear end of the chassis had to be cut out to hold the transformer.

The HW-99 features semi-break-in keying, but don't go too fast, as it keys very soft. The break-in delay is adjustable. The HW-99 has built-in sidetone, too.

The receiver is a single conversion superheterodyne design. There's a single crystal filter that supplies the bulk of the receiver's selectivity. A 450 Hz active audio filter provides the CW operator with enough bandwidth to listen to the tone, yet narrow enough to reject most nearby stations. The HW-99 does not have an internal speaker — you have to supply one yourself. There is a front-mounted phone jack, however.

There's a front mounted "S-meter" that uses a ten-segment LED bar. The strongest of signals will only light up five of the bars. This LED bar also displays relative output power. The key word here is "relative," since there is not a single mark on the panel to indicate any sensible meaning to the moving LEDs.

Since the HW-99 is a transceiver, there's an RIT control, which is kind of unusual for Heathkit. It provides about +/-2.5 kHz of travel.

Inside the HW-99

The HW-99 was built using three printed circuit boards. Like its little brother the

Continued on page 56

Photo A. *Here's the HW-99, a CW-only Novice radio.*

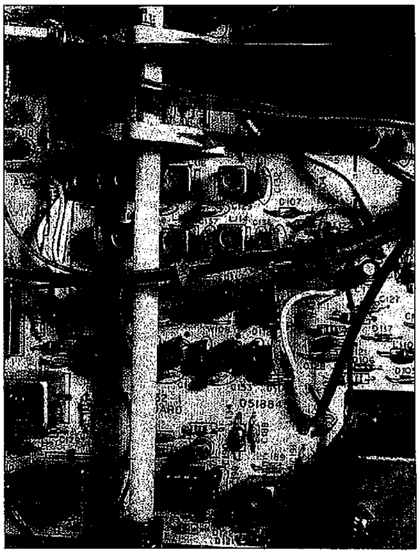

Photo B. *The transmitter bandpass filter adjustments are shown here. The bandswitch is shown going through to the rear filters.*

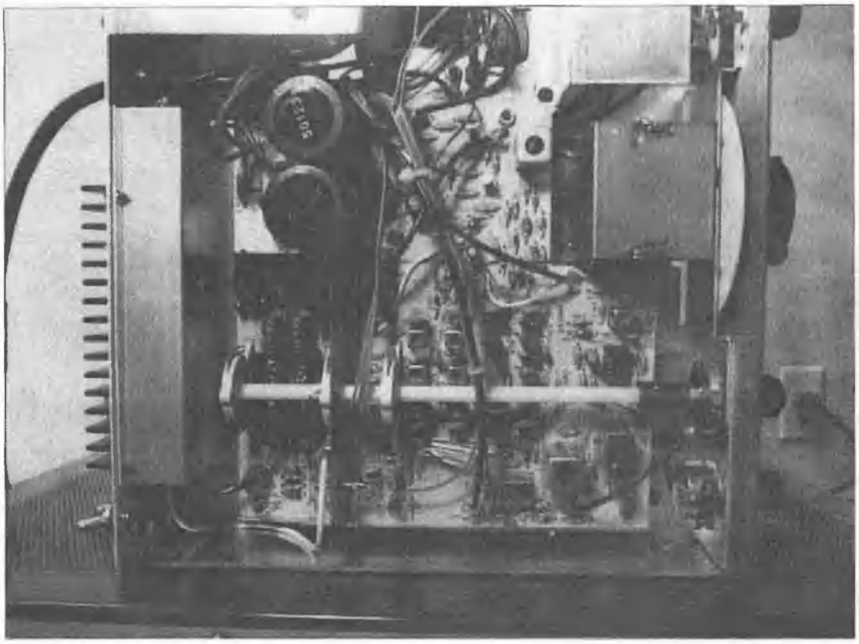

Photo C. *Inside the HW-99. This is the bottom board. Notice the final amplifier in the box mounted to the rear.*

HW-9, most of the receiver is on the top board and the transmitter, on the lower board. The final and those high voltage RF transistors are mounted in a shielded box mounted on the rear apron. What I find strange with the HW-99 is that the power supply is wired point-to-point using tie strips. The regulators are mounted to the chassis using ribbon cables and connectors.

Speaking of cables, there's a rat's-nest of wires going to and from the printed circuit boards. Many have sockets that are plugged into the circuit boards, while others are hard wired.

The VFO is mounted on the top PC board. The VFO's main components are mounted inside a metal can. The HW-99 uses a vernier drive to operate the VFO capacitor.

There's no 100 kHz calibrator. And that's a good thing, too, as there is no way to reset the dial. What you see is not really what you get. Don't waddle too close to the band edges when operating the HW-99.

The HW-99, a/k/a the "drift-o-matic"

Of all the radios I have owned, the HW-99 is by far the most drifty thing ever made. I am not talking about just drifting when turned on, but drifting up and down and all over the place and never really settling down. Heath knew about it. In fact, and I am not making this up, one of the final steps after you had assembled the HW-99 was to bake it in an oven set at 175 degrees. Really! The idea was to stabilize the VFO components so that they would not drift as much. There are instructions in the assembly manual telling you step-by-step how to set your oven correctly so you won't melt the plastic parts on the HW-99. Can the drift be fixed? Yes, as a matter of fact. There's an article in *QST* that describes a fix for the drifty HW-99. Check out the sidebar for more info.

Some of the fixes for a drifty HW-9 VFO can apply to the HW-99, as they are related. One method is to remove the coils from the VFO assembly and boil them in water for a few minutes. This "anneals" the wire and prevents drift. Another is to paint the inside of the VFO shield flat black. Since most of the drift is thermal, anything you can do to keep heat from interacting with the VFO components will help.

Operating the HW-99

There's not much to it. You dial up a station and close your CW key. The key

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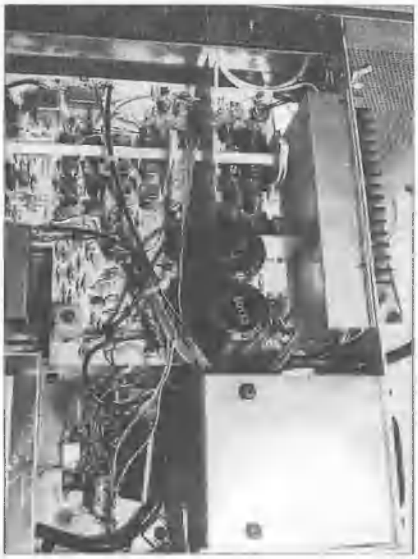

Photo D. *In the lower left corner, you'll see the voltage regulators and diodes for the power supply. The filter caps are mounted on the PC board.*

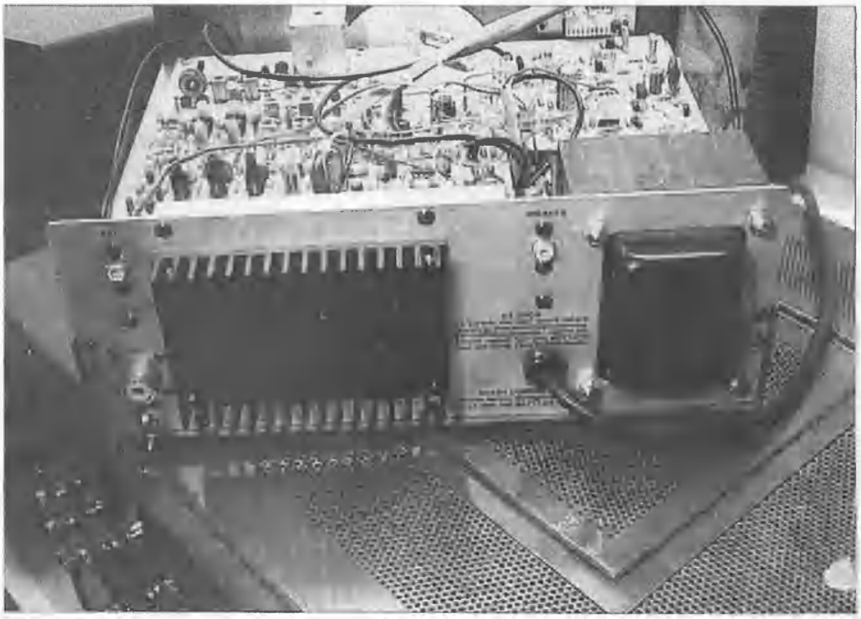

Photo E. *Here you see the final amplifier mounted to the rear apron. Notice the power transformer sticking out from the chassis.*

Letters

continued from page 8

without the clatter of a machine? Who would ever have thought it just a few years ago? But the smell of hot oil is missed!! And to communicate with someone on a bandwidth of 31 cycles. 3 QSOs in a 100-cycle band.

Then, of course, comes APRS — accurate positions to within 50 feet!!

Most of the guys with programming capability are making their discoveries available to the fraternity free as shareware. Some are trying to make money from their ham friends, but the majority of it is free and, for those charging, the next week another programmer will bring out a program that replaces the charged one for free. Some are using us as beta testers, which is GREAT.

Jack Heller, who writes for *73* magazine, has printed a table of all of the programs and list addresses for these various modes. One of the best SSTV programs (in my opinion) is still charging for their program, but there are also shareware ones available that enable you to work this mode.

Ham radio dead? Ham radio replaced by the Internet? I don't think so, if we get busy and educate the middle school–aged kids and up in what ham radio is all about. Now that "our" new satellite is up and the ISS is manned by all hams and both of these can be worked by a handie-talkie, what better way to show off ham radio?

I am still opposed to these crash courses being held on weekends to get a Tech license. It gives no one any opportunity to open the doors to what ham radio is really all about. Our course here in the high school will continue to be 10 weeks, and the persons attending will have a basic knowledge of electronics and the various modes of operation — but will be holding the key to experimentation. 73.

Arachnida Warcum

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Let's review its main points:

1. Very broadbanded.
2. Exceptionally quiet.
3. Low angle of radiation, even when close to ground.
4. No expensive, difficult-to-obtain parts.
5. High effectiveness-to-cost ratio.

And, you always get a great feeling when, in a ragchew, you say, "Antenna here is home-brew triband delta loop."

Carpe diem! Give it a try!

(Our condolences and thanks to Mac's XYL, Margery, who followed through in the publication process for this article after Mac became a silent key late last year. — ed.)

Way Cool Rocket Project

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I would like to formally thank the members of the Southern Area Rocketry Club in Atlanta GA for their help with launch operations for Sounding Rocket 101, Round 001.

The Digital Port

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virtually in capsule form ... easily administered to what should be a ready and willing generation. We have not just another means of communication, but new ways to use radio and computer technology that were unheard-of just a few short years ago.

Most of the kids in their teens have no knowledge that ham radio exists, much less of what they could do with it. In days of yore, there were many careers fostered by an early interest in ham radio. Hams became technicians and engineers. Now, we have whole new directions where ham radio can help focus bright young minds.

In addition to what I write about there are satellite communications and, believe it or not, inventions still to be made. What we really need to do is to grab the interest of the youth and help direct that focus. It could just begin to lower the average age of hams ... such a thought!

If you have questions or comments about this column, E-mail me [jheller@sierra.net]. I will gladly share what I know or find a resource for you. For now, 73, Jack KB7NO.

Hamsats

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In order to do justice to the many photos and finely detailed schematics and engineering drawings, the scanning process created some rather large files, but it was worth it. While the photos may look a bit grainy on the computer screen at first, they show excellent detail when the Acrobat Reader "zoom" function is used, and they print well enough to compete with the original. The Acrobat OCR (Optical Character Recognition) function was invoked during production to create searchable text. This is extremely convenient when looking for all instances of a particular word or phrase within a selected year.

The release date is set to coincide with the Dayton Hamvention in May, 2001. You can get your set at the AMSAT booth. The cost/donation will be much cheaper for AMSAT members, but a program will be in place to encourage new memberships at the show. If you are not planning to attend Dayton, check with [Martha@amsat.org] or call (301) 589-6062 after May 21st to place an order. You'll be glad you did!

The DX Forum

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playmate. I was so excited about the TS-2000 that I ran down and got the first one to cross the border into the State of Washington. More about that toy coming up soon.

As for the antennas, all of my antennas are hung from ropes between the numerous 130-foot-tall "weeds" in my back yard. Actually, I'm on a couple of acres approximately 20 miles due east of downtown Seattle, and there are numerous Douglas firs, Pacific red cedars, and black cottonwoods on the property that make great antenna catenary supports.

Here's the equipment brag list.

Antennas: Numerous extended double zepps at 100 feet (80–17m); 2-element modified W8JK wire beam at 70 feet (15–6m); 1/4-wave wire vertical for 80m.

Transceivers: Yaesu FT-1000D; Yaesu FT-847 (in my office); Kenwood TS-2000K; Kenwood TM-D700A; Icom 706MKIIG (in the pickup).

Other hardware: Timewave DSP599zx; PII-400MHz confuser w/ 17" NEC Multisync monitor, running DX for Windows under Windows ME; PK232MBX; Nye-Viking Wattmeter; Henry 2k Classic X (loudenboomen mit spitz und sparken); MFJ -989C tuner; Heil Goldline 4 microphone; and a set of super-smooth, DX-enhancing Vibroplex iambic paddles

Well, that's enough showing off for me. Now you know what you're up against in the pileups.

Pulling the big switch

So much for this month's offering. Don't forget to drop me a line at [n6nr@arrl.net] and let me know what you think of the changes that will be coming down the road. You are welcome to contribute material — as a matter of fact, I strongly encourage it. See you in the pileups! 73 and good DX!

On the Go

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dust devils. When you take the SkyWarn training, you will learn about wall clouds. This is a very significant sign that should be immediately reported. (No, I'm not going to explain wall clouds — that's my sneaky way to get you to the SkyWarn course.) In any case, don't take it upon yourself to identify a questionable event as a tornado over the air. With people monitoring amateur frequencies, this can cause panic. Check with your NWS contacts as to what they recommend.

4. SkyWarn operations are organized. In SkyWarn, we are there to assist the Weather Service. This means that we need to understand what they need and organize our operation to meet those needs. Commonly, the NWS may wish to have a ham operator on site at the weather station. In many cases, there is an actual operating position for the SkyWarn operator. This means that the meteorologists can readily let him or her know what they need to find out. I have found it easiest to have a separate net control whenever possible. This lets the operator at the Weather Service concentrate on the meteorologists and the net control concentrate on the radio traffic.

I have a few more suggestions that may help your SkyWarn efforts. First, this is a great opportunity for clubs to work together. This may lead to some other shared service opportunities. Second, if you're looking for new hams among our school-age folks, mentioning SkyWarn may raise some additional interest. Third, be open to new ideas; APRS is becoming very popular in SkyWarn efforts. This allows the location of the storm to be indicated right on a computer-generated map. Fourth, SkyWarn presents a great opportunity to explain to your neighbors why those antennas in your back yard are a benefit to them. I always make sure to mention that I often know about the bad weather before the weather alert radios go off. For some reason, when the neighbors feel that those antennas may provide for their personal safety, they are much more supportive!

Calendar Events

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21st–1900Z April 22nd, in celebration of the 5th Anniversary of the Extra Terrestrial Hwy. (NV State Hwy. 375), the gateway to the mysterious Area 51. Frequencies: 3.996, 7.260, 14.237, 21.371, 29.250, with some 6 and 2 meters. Map coordinates 115.47 by 37.40; grid square No. DM 27. Certificates will be sent upon receipt of a 9 x 12 SASE with two units of First Class postage. Send to *SARAN, P.O. Box 9717, Las Vegas NV 89191-0717 USA. Talk-in on 146.52, ETs, call home.*

Homing In

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with a rubber duck helical antenna," says Dave. "Of course, this doesn't mean that you can't put the antenna near power lines to distort the pattern, or have the antenna stuck in the ground down a river bank so all the RF shoots up and down the river's course.

"Nottingham is sited on the River Trent," Dave continues. "There are only two places to cross. The bridges are a long way apart either side of the city. It is a clever trick to hide by the river so hunters may choose the wrong bank. They then have a frustrating long drive around and can easily come in last whilst doing so!"

Point scores are awarded for placings in each hunt, and a team's best six of seven scores determine its year-end standing. So if you miss one hunt or do poorly on one, you still have a shot at the year's championship. Everybody can have a bad night now and then, as Dave relates: "On our last foxhunt of the season, we came in a pathetic fourth. We got a reasonable bearing from the start and dashed off, hoping to get a head start on the rest of the teams. The trail went cold for the next few transmissions and we got stuck behind every learner driver and old lady scared of third gear and giant snails!

"By the time we got a good bearing, we were a way off track and had to cut across country down twisty lanes in the pitch black. The fox was under a small river bridge amongst some derelict buildings in the middle of nowhere. He had a lot of nerve, as I wouldn't have considered that place in

midsummer. Fortunately, we still had enough points in hand to give us the overall championship for a fifth season."

Every so often, a special hunt provides a change of pace. "GØPSI and I volunteered to be fox on the annual 430 MHz on-foot "fun hunt," Dave relates. "We really fooled the teams. The start is at the clubhouse, and we could hide within a one-mile radius. The single-story clubhouse has two large rooms and various smaller kitchen and janitor's rooms. On a club night, one room has the radio club and the other has a Scrabble club. We hid in the Scrabble club's kitchen, 20 paces away from the start.

"Running one watt to a 'slim-jim' antenna, there were reflections everywhere," he continues. "Only one team found us after an hour. I must admit to believing that everyone would be there in 20 seconds, but John won the day and was proved to be right. Lots of egg on faces, as most teams spent an hour and a half in the dark, frost, and rain wandering round the surrounding streets trying to make sense of the readings. Really funny!

"Hiding or hunting, we are still the team to beat," G6UWO proclaims. Partial credit for Dave and John's high scores goes to their unique RDF system, which includes a motorized yagi (**Photo D**) and associated bearing display unit (**Photo E**). In an upcoming "Homing In," G6UWO will disclose the details of this "secret weapon," which may inspire you to make one of your own. Meanwhile, keep the letters and E-mails coming. Addresses are at the beginning of this article.

QRP

continued from page 56

will switch a positive voltage to ground. Just about any electronic keyer will work. Key the radio and adjust the drive control until all the LEDs light. You don't want to run the drive at maximum; it won't produce any more RF to the antenna, but will generate lots of crud on your signal.

The active filter is kind of tight for my ears. The filter does not ring. The sidetone volume can be set to your liking.

That's about it for the HW-99. Like I said, it's not really a QRP radio, but it can easily be turned down to QRP power levels. It's drifty as hell and you can't operate it from a 12-volt battery at Field Day. Now, having said all of that, since Heathkit only produced the HW-99 for just a short time, they are very rare! Introduced at $299, I've seen them go for over $500 on e-Bay. If you see one, it would make a great addition to your Heathkit HW series of QRP radios.

QRX

continued from page 6

2. To carry this cola syrup (the concentrate), the commercial truck must use the hazardous materials place cards reserved for highly corrosive substances.

3. The distributors of this cola have been using it to clean the engines of their trucks for about 20 years!

Still want to drink up?

From the Internet.

Never Say Die

continued from page 4

agents were tipped by their pagers not to come to work that day. The ATF quickly denied this, claiming that one agent had been in an elevator with a DEA agent when the blast went off, and that the elevator fell five stories. They said the two agents then forced the doors open and rescued many survivors. The DEA agent, on the strength of this story, won the National Policeman of the Year Award for his heroism.

20/20 interviewed the elevator maintenance men, who said that the story was pure fantasy. They'd inspected the elevators after the blast and found them all in perfect condition. They said they couldn't possibly have fallen, as the ATF claimed.

As I've noted in a past editorial, one reader who is an expert on bombs said that a bomb made of the material (fertilizer) claimed would have created a horrendous stink, yet not one witness ever mentioned any smell. And what about the seismographs indicating there were two blasts, which many witnesses confirmed?

Well, we've recently seen TV investigative reports that the FBI did, indeed, use incendiary devices at Waco, though they denied it. They also denied shooting into the compound, yet we've now seen the flashes from their guns recorded on film from a helicopter over the compound.

Will we ever find out what the real story was in Oklahoma City? Hell, it's been over 60 years since Amelia Earhart disappeared and the government is still covering up the embarrassment of having recruited the most famous woman in the world as a spy.

Our government seems to classify information more to cover its own actions than to prevent it from getting into unfriendly foreign hands. And they wonder why more and more Americans are in fear of the government, and don't trust it.

We have the same endless cover-ups when it comes to UFOs and aliens.

Sure, I'm crazy for being convinced by overwhelming evidence that the Moon landings were faked. The true believers are convinced that we were able to send mission after mission to land on the Moon, even though 30 years later, when we have vastly more sophisticated systems, we've been unable to get most of our landers to Mars. Phooey.

Double-Blind Baloney

One of the most trusted scientific tests for medical procedures is the double-blind test, where neither the doctor nor the patient knows which of the test procedures is the test and which is the control. This test is so trusted by scientists

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PROPAGATION

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Special DX Forecast

Due to seasonal improvements in ionization, April is historically one of the best months for the HF bands. When conditions go sour the VHF bands often perk up, so there is usually something you can work. However, overall DX conditions will still only rate a four or five on a scale of ten.

No intense geomagnetic disruptions are expected, but coronal holes, minor flares, and other solar events will continue to make regular HF communications challenging. The worst periods, as shown on the calendar, are likely to be the 6th through 8th, 14th and 15th, and 27th through 30th.

The best days often closely precede or follow the worst ones, and the 5th, 13th, 18th, 22nd, and 25th are my picks. In general, afternoons and evenings will provide the most openings when conditions aren't very good, especially if you're not looking for a particular contact.

Band-by-Band Summary

10/12 meters

Regular daytime opportunities early in the month, but expect their usefulness to dramatically decrease by the time May arrives. Openings will be to the east in the morning and to the west during the afternoon. Peaks occur in the afternoon, and you might try Africa just after midday for rarer contacts. Short-skip distances will fall between 1,000 to 2,500 miles.

15/17 meters

I expect these to be excellent, especially to the southern hemisphere. Signals peak before noon toward Europe, in Central and South America around midday, and to the west from late afternoon into the evening. Try long paths into the southern hemisphere to find unusual contacts. Short-skip will average around 1,000 miles.

April 2001						
SUN	MON	TUE	WED	THU	FRI	SAT
1 F-P	2 F	3 F	4 F-G	5 F-G	6 F-P	7 P
8 F-P	9 F	10 F-P	11 F-P	12 F-G	13 G	14 F-P
15 P	16 F	17 F-G	18 G	19 F-G	20 F	21 F-G
22 G	23 F-P	24 F	25 F-G	26 F-G	27 F-P	28 P
29 F-P	30 F-P					

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
EASTERN UNITED STATES TO:												
Central America	(15) 20	(15) 20	20 (40)	(20-40)	x	x	x	(10)	(10)	(10-15)	10 (17)	12-20
South America	(17) 20	20 (40)	20 (40)	(20-40)	x	x	x	(10)	(10)	(10-15)	10-15	10 (20)
Western Europe	(20-40)	(30-40)	(30-40)	(40)	x	x	(15-20)	(10-20)	(10)17	15-20	(15) 20	(20)
Southern Africa	(17) 20	(20-40)	(20)	(20)	x	x	x	x	(10)	10 (15)	12 (17)	(15-20)
Eastern Europe	x	(30-40)	(20-40)	(17-20)	(20)	x	x	(10-15)	(15)	(17-20)	(20)	(20)
Middle East	x	(20)	20	(20-40)	(40)	x	x	x	(10-15)	15	(17-20)	(20)
India/ Pakistan	(17-20)	x	x	x	x	x	x	(15-17)	x	x	x	x
Far East/ Japan	(17-20)	(20)	x	x	x	x	x	x	x	x	x	(15)
Southeast Asia	(17-20)	x	x	x	x	x	(17-20)	(10-15)	x	x	x	x
Australia	(15)	(17-20)	x	x	x	x	(20-40)	(20)	(10)	x	x	x
Alaska	(15) 20	(20)	(20-30)	(30-40)	(40)	x	x	x	(15-20)	(10-20)	(10)17	15-20
Hawaii	(15) 20	20	(20-40)	(20-40)	(40)	x	x	x	(15-20)	(10-20)	(10-20)	15-20
Western USA	15-20	20 (40)	20 (40)	(20) 40	(30-40)	x	x	(10-20)	10 (20)	10 (20)	10 (20)	(15) 20
CENTRAL UNITED STATES TO:												
Central America	(15-20)	20 (40)	20-40	20-40	(20-40)	x	(10-20)	10-20	10-20	10 (20)	10 (20)	10-20
South America	(15) 20	17-30	20 (40)	20 (40)	x	x	x	(10-20)	10 (20)	10 (15)	(10-20)	12 (20)
Western Europe	(20)	(40)	(40)	x	x	x	x	(15)	(15-17)	(15-20)	(17-20)	(20)
Southern Africa	20	(20)	(20)	(20)	x	x	x	x	(10)	(10-15)	(10-17)	(15-20)
Eastern Europe	(20)	(20)	x	x	x	x	x	(15)	(15-17)	(17-20)	(20)	(20)
Middle East	x	x	x	x	x	x	x	x	(15)	(15)	(20)	(20)
India/ Pakistan	(17-20)	(15-20)	x	x	x	x	x	(15-20)	x	x	x	x
Far East/ Japan	(17-20)	(20)	x	x	x	x	x	x	x	x	x	(15)
Southeast Asia	(15-20)	x	x	x	x	x	x	(20)	(10-20)	x	x	x
Australia	(15-20)	(20)	x	x	x	x	x	(15-20)	(15-20)	15	15	15 (20)
Alaska	15-20	(15) 20	20	20 (30)	(30-40)	(40)	x	x	x	(10-20)	10-20	10 (20)
Hawaii	15-20	(15) 20	20 (40)	(30-40)	(40)	x	x	x	x	(10) 12	10-15	(10) 17
WESTERN UNITED STATES TO:												
Central America	10-20	15-20	15-30	(14) 40	20-40	(30-40)	x	(15-20)	10 (20)	10 (20)	10 (20)	10 (20)
South America	(10) 20	(15) 20	20 (40)	20 (40)	x	x	x	(10-20)	10 (20)	(10-15)	10 (15)	10 (20)
Western Europe	x	x	x	x	x	x	x	x	(15-17)	(15-17)	(17-20)	(17-20)
Southern Africa	(20)	(20)	(20)	(20)	(20)	x	x	x	x	(10-12)	(12) 17	(15-20)
Eastern Europe	x	x	x	(17-20)	(17-20)	x	x	(15)	(15)	(15-17)	(17-20)	(20)
Middle East	x	(20)	(20)	x	x	x	x	x	(15-17)	(20)	(20)	(20)
India/ Pakistan	x	(17-20)	x	x	x	x	x	x	(15-17)	x	x	x
Far East/ Japan	10-20	(20)	x	x	x	(40)	(40)	x	x	x	x	(10-20)
Southeast Asia	(10-15)	(10-15)	x	x	x	x	x	x	x	(15-20)	(15-20)	(10-15)
Australia	(10-15)	(15)	(17-20)	x	x	x	x	x	(15) 20	(15-20)	(15)	(10)
Alaska	(10) 20	(15) 20	20 (40)	(20) 40	(30-40)	(40)	(40)	(40)	x	(10-15)	10-15	10-20
Hawaii	(15) 20	20	(20-40)	(20) 40	(30-40)	(40)	x	x	x	(10-20)	(10) 20	15-20
Eastern USA	15-20	20 (40)	20 (40)	(20) 40	(30-40)	x	x	(10-20)	10 (20)	10 (20)	10 (20)	(15) 20

Table 1. Band, time, country chart. Plain numerals indicate bands which should be workable on Fair to Good (F-G) and Good (G) days. Numbers in parentheses indicate bands usually workable on Good (G) days only. Dual numbers indicate that the intervening bands should also be usable. When one number appears in parentheses, that end of the range will probably be open on Good (G) days only.

20 meters

20 meters provides communications to most areas of the world when HF conditions are good, and is usually the place to look for openings when conditions are not so good. Peaks occur in the two hours after sunrise and just before sunset. The southern hemisphere should provide particularly strong DX signals. Short skip will fall between 500 and 2,500 miles.

30/40 meters

Probably your best choices from late evening until sunrise. The strongest and most frequent openings will be to the southern hemisphere, but atmospheric noise will increase as the subtropics heat up. The Middle East and Asia may provide some of your rarer contacts. Short skip will be under 1,000 miles during the day over 750 miles at night.

80/160 meters

These bands can provide some communications during the period from sunset to sunrise, but can't be relied upon with any regularity. Noise from storms really begins to limit openings at this time of year, but they're still worth investigating if 40 meters is open. Short-skip on 80 meters averages over 2,000 miles at night and around 300–400 miles during the day. Short-skip on 160 meters falls between 1,000 and 2,000 miles at night. 73

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that billions of dollars of pharmaceutical money often depend on its validity.

Over 50 years ago, J.B. Rhine discovered that the double-blind test could be invalidated if the subjects ever were in the future apprised of the results. This unexpected discovery set Rhine back several years in his research. From then on, he had to set up his experiments so that the participants would never be made aware of the results.

This strange time phenomenon has more recently been confirmed by the Princeton PEAR Labs research.

It's something like morphic resonance, which has also been confirmed by researchers, as I've reported.

Yes, it's weird that just by my finding out what the answers are to a quiz a day or a year later will affect the way I answer the quiz questions. But then, we have plenty of evidence that time isn't just what we experience consciously. We know that researchers have confirmed beyond any question that precognition is a fact. Well, when we find out the answers to a test in the future, all it takes is some precognition to influence our answers.

So much for the scientific dependence on double-blind research.

Do Gooders

The campaign rhetoric over abortion and right-to-life is a triumph of emotion over reason. Phooey. Yes, I know, you are passionately in favor of the right-to-life. Or abortion rights. Well, shame on both your houses. First, this is a religious matter that our beloved courts have managed to get embroiled in. It's a case where one set of true believers wants to force another set to do as they believe, just because their belief is right.

We see examples of people killing to force their beliefs on others all around the world. Indeed, some right-to-lifers are willing to kill others to enforce their belief.

My question to the right-to-lifers is: Where were you when nearly a million people were slaughtered in Burundi not long ago? And what are your beliefs about the current slaughter in Rwanda? And about a dozen other African countries? Don't look away from me.

Either life is valuable or it isn't. Your silence over the deaths in Kosovo, Chechnya, Tibet, Sri Lanka, Burma, East Timor, and so on is deafening. I want to see some shred of evidence that you actually do care about life.

Americans twiddled their thumbs, eating popcorn and watching ball games while Stalin killed tens of millions of his people. Ditto Mao. Ditto Amin, and so on.

Oh, yes, you were smiling while the Iranians and Iraqis were at war, killing off a generation of their kids. Well, those kids aren't nearly as important as the teenage mother abortion of an American illegitimate, black, crack-crippled-for-life baby, right?

Reform? Har-de-Har

McCain made a fuss over campaign finance reform. That's a crock of campaign rhetoric.

First, if money didn't buy measurable, reliable results, big businesses and big unions wouldn't be spending tens to hundreds of millions of dollars to bribe Congress. Yes, of course they're bribes. And if the bribes weren't working, the money would quickly dry up and the thousands of lobbyists would be seeking other, possibly more honest, work.

Congressmen have to spend hundreds

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of thousands to millions to get elected and re-elected, so they *have* to accept the bribes, or they'll be forced to go back to their law firms.

Why do election campaigns cost millions? Because money buys votes. Like any war, the more arms your opponent has, the more you need to keep from being wiped out. So if your opponent for office buys newspaper, radio, and TV ads, you had damned well better do it too, or you're a dead duck on election night.

All politicians understand this situation. But they also know that the public is upset when they learn that millions are being spent to be elected, so they cater to this emotion, knowing that there isn't a chance in hell of any real change being made in the system.

It gets worse. The Republicans have a serious cross to bear, one which forces them to shake the money trees much harder than the Democrats. In the last election 89% of the media voted for Clinton. In practical terms this means that most reporters are going to be slanting their stories toward liberal candidates. There isn't even a remotely even playing field for the Republicans. And that goes for newspapers, magazines, radio, and TV.

One possible solution to this, if there were to be any interest in easing the problem, would be for Congress to pass a law which made it illegal for them to discuss on the floor or vote on any legislation where they might have a conflict of interest. Yes, I know, there's no way Congress is going to do anything which might slow down the cash flow, so that's just an empty proposal.

Unless ...

Unless state legislatures passed state laws to that effect which would impact their Congressmen. And this is one reason why I've been asking the people who have read my three *Secret Guides* and benefited from them health- and wealth-wise to consider running for their state legislatures. With this leverage, they could effect Congressional finance reform, plus get busy cutting school costs, while enormously improving the educational product, and ditto health care.

Any candidates who talk about campaign finance reform are blowing smoke, and they knows it. They're lying because their pollsters told them this is a hot button with the voters.

Movies

Being thrifty, I go to the matinee performances at the fairly nearby cineplexes. Well, they're all of about a 45-minute drive, but that's the penalty of living on a farm not far from nowhere. With most of the movies not worth the trip, much less the ten bucks entry fee (for two), I don't go very often. But when Sherry and I do go, the theater seldom has more than a half dozen in the audience. Sometimes we're the only ones there!

Lordy, when I was a kid the nearest theater was just a few blocks away. It had two features and six acts of live vaudeville between the movies. I'm talking Pennsauken, New Jersey, not a city.

Later, when we moved to Brooklyn in 1933, I used to go to the movies on Saturday afternoon. For 10 cents they had two main features, a full-length western, two serials, six cartoons, the news, and they had drawings for prizes. I won a baseball mitt. The nearest theater was down at the corner, with six theaters within easy walking distance.

The evening movies were priced at 25¢. The theaters ran two main features, a cartoon, a newsreel, and the performances were continuous. The idea of a starting time for a movie wasn't even considered. We just went in and watched.

Unlike today's cineplexes, our theaters were huge, with a thousand or more seats, and they were usually packed every night, including the balcony. Often I'd have to stand at the back of the theater, watching for someone to get up and leave before I could get a seat. Then there was the race to get to it first. That was before popcorn and drinks had been invented. However, they did have a candy counter and Holloway's Milk Duds.

During my high school days I often took the subway to Coney Island, where I'd get a plate of fried scallops, lots of tartar sauce, and a plastic fork at Nathan's Famous, across the street from a theater. Nathan's was famous for their hot dogs, though at that time the Coney Island stand was all they had. Now I see Nathan's on Broadway and even at airports. Why are their hot dogs outstanding? The secret ingredient is nutmeg. Don't tell anyone. The stand was started by Nathan Handwerker in the 1920s and it's still going strong.

Coney Island was a fairly high-class amusement area until the 1939 World's Fair. The Fair drew away the people with money, so Coney Island had to lower its prices to attract poorer people, and it never recovered. The quality amusements gradually were driven out of business, leaving the area more like a cheap carnival, with a large black and Hispanic clientele. And it's filthy today.

TV sure has changed the movie business. I remember in 1948, when I bought an 8-inch RCA 630-TS black-and-white TV for $350. My mother thought it was a terrible waste of money—no one would bother watching it. It didn't take long before my dad was watching every western, wrestling, and so on. Soon my mother and dad were glued to the TV every night. I wasn't there at night because I was the chief cameraman at WPIX, channel 11. From there I graduated to being a producer-director in Dallas and then Cleveland, where I directed their network news program for all of Ohio. It was at about that time that I figured out that working for others wasn't the key to getting anywhere and started manufacturing loudspeaker enclosures.

You're probably old enough so the old movie theaters, with SRO, aren't news—but maybe, if you take your grandchildren in your lap and read this to 'em, the way my grandfather used to read to me, they'll enjoy this ancient history visit.

Goose Your Imagination

My *Secret Guide to Wealth* urges my readers to consider some field that sounds like a lot of fun and look for a job with a small company in that field, and then learn everything possible. But I'm getting letters from whiners saying they don't know what they're interested in. Good grief!

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Wise Up!

Here are some of my books which can change your life (if you'll let 'em). If the idea of being healthy, wealthy and wise interests you, start reading. Yes, you can be all that, but only when you know the secrets which I've spent a lifetime uncovering.

......Wayne

The Bioelectrifier Handbook: This explains how to build or buy ($155) a little electrical gadget that can help clean the blood of any virus, microbe, parasite, fungus or yeast. The process was discovered by scientists at the Albert Einstein College of Medicine, quickly patented, and hushed up. It's curing AIDS, hepatitis C, and a bunch of other serious illnesses. The circuit can be built for under $20 from the instructions in the book. $10 (#01)

The Secret Guide to Wisdom: This is a review of around a hundred books that will help you change your life. No, I don't sell these books. They're on a wide range of subjects and will help to make you a very interesting person. Wait'll you see some of the gems you've missed reading. $5 (#02)

The Secret Guide to Wealth: Just as with health, you'll find that you have been brainwashed by "the system" into a pattern of life that will keep you from ever making much money and having the freedom to travel and do what you want. I explain how anyone can get a dream job with no college, no résumé, and even without any experience. I explain how you can get someone to happily pay you to learn what you need to know to start your own business. $5 (#03)

The Secret Guide to Health: Yes, there really is a secret to regaining your health and adding 30 to 60 years of healthy living to your life. The answer is simple, but it means making some difficult lifestyle changes. Will you be skiing the slopes of Aspen with me when you're 90 or doddering around a nursing home? Or pushing up daisies? No, I'm not selling any health products. $5 (#04)

My WWII Submarine Adventures: Yes, I spent from 1943-1945 on a submarine, right in the middle of the war with Japan. We almost got sunk several times, and twice I was in the right place at the right time to save the boat. What's it really like to be depth charged? And what's the daily life aboard a submarine like? How about the Amelia Earhart inside story?If you're near Mobile, please visit the Drum. $5 (#10)

Wayne's Caribbean Adventures: My super budget travel stories – where I visit the hams and scuba dive most of the islands of the Caribbean. You'll love the special Liat fare which let me visit 11 countries in 21 days, diving all but one of the islands, Guadeloupe, where the hams kept me too busy with parties. $5 (#12)

Cold Fusion Overview: This is both a brief history of cold fusion, which I predict will be one of the largest industries in the world in the 21st century, plus a simple explanation of how and why it works. This new field is going to generate a whole new bunch of billionaires, just as the personal computer industry did. $5 (#20)

Cold Fusion Journal: They laughed when I predicted the PC industry growth in 1975. PCs are now the third largest industry in the world. The cold fusion ground floor is still wide open, but then that might mean giving up watching ball games. Sample: $10 (#22).

Julian Schwinger: A Nobel laureate's talk about cold fusion—confirming its validity. $2 (#24)

Improving State Government: Here are 24 ways that state governments can cut expenses enormously, while providing far better service. I explain how any government bureau or department can be gotten to cut it's expenses by at least 50% in three years and do it cooperatively and enthusiastically. I explain how, by applying a new technology, the state can make it possible to provide all needed services without having to levy *any* taxes at all! Read the book, run for your legislature, and let's get busy making this country work like its founders wanted it to. Don't leave this for "someone else" to do. $5 (#30)

Mankind's Extinction Predictions: If any one of the experts who have written books predicting a soon-to-come catastrophe which will virtually wipe most of us out are right, we're in trouble. In this book I explain about the various disaster scenarios, like Nostradamus, who says the poles will soon shift (as they have several times in the past), wiping out 97% of mankind. Okay, so he's made a long string of past lucky guesses. The worst part of these predictions is the accuracy record of some of the experts. Will it be a pole shift, a new ice age, a massive solar flare, a comet or asteroid, a bioterrorist attack? I'm getting ready, how about you? $5 (#31)

Moondoggle: After reading René's book, *NASA Mooned America*, I read everything I could find on our Moon landings. I watched the videos, looked carefully at the photos, read the astronaut's biographies, and talked with some of my readers who worked for NASA. This book cites 25 good reasons I believe the whole Apollo program had to have been faked. $5 (#32)

Classical Music Guide: A list of 100 CDs which will provide you with an outstanding collection of the finest classical music ever written. This is what you need to help you reduce stress. Classical music also raises youngster's IQs, helps plants grow faster, and will make you healthier. Just wait'll you hear some of Gotschalk's fabulous music! $5 (#33)

The Radar Coverup: Is police radar dangerous? Ross Adey K6UI, a world authority, confirms the dangers of radio and magnetic fields. $3 (#34)

Three Gatto Talks: A prize-winning teacher explains what's wrong with American schools and why our kids are not being educated. Why are Swedish youngsters, who start school at 7 years of age, leaving our kids in the dust? Our kids are intentionally being dumbed down by our school system — the least effective and most expensive in the world. $5 (#35)

Aspartame: a.k.a. NutraSweet, the stuff in diet drinks, etc., can cause all kinds of serious health problems. Multiple sclerosis, for one. Read all about it, two pamphlets for a buck. (#38)

One Hour CW: Using this sneaky booklet even *you* can learn the Morse Code in one hour and pass that dumb 5wpm HF entry test. $5 (#40)

Code Tape (T5): This tape will teach you the letters, numbers and punctuation you need to know if you are going on to learn the code at 13 or 20 wpm. $5 (#41)

Code Tape (T13): Once you know the code for the letters (#41) you can go immediately to copying 13 wpm (using my system). This should only take a couple of days. $5 (#42)

Code Tape (T20): Or, you can start right out at 20 wpm and master it in a weekend. $5 (#43)

Wayne Un-Dayton Talk: This is a 90-minute tape of the talk I'd have given at the Dayton, if invited. $5 (#50)

Wayne Tampa Talk: This is the talk I gave at the Tampa Global Sciences conference—where I cover amateur radio, cold fusion, health, books you should read, and so on. $5 (#51)

$1 Million Sales Video: The secret of how you can generate an extra million dollars in sales just by using PR. This will be one of the best investments you or your business will ever make. $40 (#52)

Reprints of My Editorials from *73*. Very few things in this world are as we've been taught, and as they appear. I blow the whistle on the scams around us, such as the health care, our school system,. our money, the drug war, a college education, sugar, the food giants, our unhealthy food, fluorides, EMFs, NutraSweet, etc.

1996 Editorials: 120 pages, 100 choice editorials. $10 (#72)

1997 Editorials: 148 fun-packed pages. 216 editorials. $10 (#74)

1998 Editorials: 168 pages that'll give you lots of controversial things to talk about on the air. $10 (#75)

1999 Editorials: 132 pages of ideas, book reviews, health, education, and anything else I think you ought to know about. $10 (#76)

2000 Editorials: In the works.

Silver Wire: With two 3-in. pieces of heavy pure silver wire + three 9V batteries you can make a thousand dollars' worth of silver colloid. What do you do with it? It does what the antibiotics do, but germs can't adapt to it. Use it to get rid of germs on food, for skin fungus, warts, and even to drink. Read some books on the uses of silver colloid, it's like magic. $15 (#80)

Wayne's Bell Saver Kit. The cable and instructions enabling you to inexpensively tape Art Bell W6OBB's nightly 5-hr radio talk show. $5 (#83)

NH Reform Party Keynote Speech. It wow'd 'em when I laid out plans for NH in 2020, with much better, yet lower-cost schools, zero state taxes, far better health care, a more responsive state government, etc. $1 (#85)

Stuff I didn't write, but you need:

NASA Mooned America: René makes an air-tight case that NASA faked the Moon landings. This book will convince even you. $25 (#90)

Last Skeptic of Science: This is René's book where he debunks a bunch of accepted scientific beliefs – such as the ice ages, the Earth being a magnet, the Moon causing the tides, and etc. $25 (#91)

Dark Moon: 568 pages of carefully researched proof that the Apollo Moon landings were a hoax—a capping blow for René's skeptics. $35 (#92)

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Barter 'n' Buy

Turn your old ham and computer gear into cash now. Sure, you can wait for a hamfest to try and dump it, but you know you'll get a far more realistic price if you have it out where 100,000 active ham potential buyers can see it, rather than the few hundred local hams who come by a flea market table. Check your attic, garage, cellar and closet shelves and get cash for your ham and computer gear before it's too old to sell. You know you're not going to use it again, so why leave it for your widow to throw out? That stuff isn't getting any younger!
The *73* Flea Market, Barter 'n' Buy, costs you peanuts (almost)— comes to 35 cents a word for individual (noncommercial!) ads and $1.00 a word for commercial ads. Don't plan on telling a long story. Use abbreviations, cram it in. But be honest. There are plenty of hams who love to fix things, so if it doesn't work, say so.
Make your list, count the words, including your call, address and phone number. Include a check or your credit card number and expiration. If you're placing a commercial ad, include an additional phone number, separate from your ad.
This is a monthly magazine, not a daily newspaper, so figure a couple months before the action starts; then be prepared. If you get too many calls, you priced it low. If you don't get many calls, too high.
So get busy. Blow the dust off, check everything out, make sure it still works right and maybe you can help make a ham newcomer or retired old timer happy with that rig you're not using now. Or you might get busy on your computer and put together a list of small gear/parts to send to those interested?

Send your ads and payment to: *73 Magazine*, Barter 'n' Buy, 70 Hancock Rd., Peterborough NH 03458 and get set for the phone calls. The deadline for the June 2001 classified ad section is April 10, 2001.

NEVER SAY DIE

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All you have to do is open your eyes and look around! For instance, if you've been reading my editorials you know that there is a growing need for day care centers as women are forced by today's prices to keep on working instead of staying at home, caring for their babies. Next time, I'll tell you (among other things) how to become a day care mogul.

First Avian QSO

At press time, reports were reaching *73* that the first legal avian QSO was scheduled to take place between 9M6's "Will the Bill," shown on our cover, and Abe Prull FØOL on ... er ... April 1st.

THE NEW! 73 Amateur Radio Today

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A New Shape on the Horizon

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QRX . . .

In Case You've Forgotten

Here is the Amateur Radio Code, as found in the 1955 *ARRL Handbook:*

1. The Amateur is Gentlemanly. ... He never knowingly uses the air for his own amusement in such a way as to lessen the pleasure of others. He abides by the pledges given by the ARRL in his behalf to the public and the Government.

2. The Amateur is Loyal. ... He owes his amateur radio to the American Radio Relay League, and he offers it his unswerving loyalty.

3. The Amateur is Progressive. ... He keeps his station abreast of science. It is built well and efficiently. His operating practice is clean and regular.

4. The Amateur is Friendly. ... Slow and patient sending when requested, friendly advice and counsel to the beginner, kindly assistance and cooperation for the broadcast listener; these are the marks of the amateur spirit.

5. The Amateur is Balanced. ... Radio is his hobby. He never allows it to interfere with any of the duties he owes to his home, his job, his school, or his community.

Continued on page 6

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Never say die

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Die De Die

When I got interested in electronics, the first thing I did was join my high school radio club (W2ANU). When I got interested in photography, I joined the school camera club. When I got interested in books, I joined the book club. And my interest in Gilbert and Sullivan got me to join the Savoyards club, where we put on *The Mikado* in front of an audience of over 5,000 students. I played the part of Koko, the Lord High Executioner. In *The Pirates of Penzance,* I played Major-General Stanley.

I don't think my joining a club is out of the ordinary. My point is that when kids get interested in electronics or radio today there should be a welcoming club available. The best place is in high schools, but lacking that, the nearby radio clubs should be doing everything in their power to get kids to come to the meetings.

The next step is to make sure that the youngsters have a good time and learn things. Club meetings should be both fun and educational.

On the fun side, I was disappointed when I offered to get on the telephone and give talks to ham clubs anywhere in the country — and not one club took me up on it.

Clubs are extremely important in keeping our hobby going. If my high school hadn't had a ham club, I might well have just continued to build hi-fi gear and other gadgets.

It was my interest in ham radio that got me to go to an engineering university and, in my junior year, be elected president of the ham club (W2SZ). I took a club with 15 members and built it to over 400 within a year.

If your club puts up meeting notices on all nearby school bulletin boards, on the boards of local markets, the Radio Shack, in the local papers, on local radio stations, and so on, people will start coming to see what it's all about.

Then, if your club meetings are boffo, they'll be back.

What helps make meetings fun? First, and foremost, get newcomers to talk about themselves.

How about a short report from a DXer on what he's worked recently. Ditto a member on SSTV, RTTY, packet, on the ham satellites, and so on. Anyone with a new rig should bring it in to show and tell. Keep the talks short — maybe five minutes each.

Put an amplifier on the telephone and have a talk by an expert in the ham industry. You won't have any problem getting good speakers. Heck, I can go on for hours about the adventures amateur radio has provided me. I can talk about the day Khrushchev saved amateur radio (I was there). And about the greatest disaster in the history of the hobby.

For those interested, you might have a Q&A session on the license tests to help people learn some electricity fundamentals.

ITU 2003?

The next World Radiocommunications Conference (WRC) is scheduled for the summer of 2003. So what does that mean to you? Well, it means that this is going to be the time when a lot of the radio spectrum is going to get new users — very possibly some of ours. Having been one of the U.S. delegates to a past WRC, where we came tha-a-a-t close to losing much of our HF bands, I have some perspective on how these conferences work.

The International Telecommunications Union (ITU) conferences work on the basis of one country, one vote, so Chad has as much say in how our ham bands will end up as the U.S., Japan, or the U.K.

Well, at least we'll have the U.S. delegation fighting for us, right?

Most of the U.S. delegation is there representing the needs of their industries, not amateur radio. At the conference where I was a delegate, I heard unanimous support for maintaining the current ham band allocations from the other U.S. delegates. That was very reassuring — except, when I took them out individually to lunch or dinner, they all confided that their instructions were to support amateur radio, but if their service were to be in danger of losing any frequencies, they were to do everything in their power to see that the loss was shifted to the nearest ham band, thus preserving their frequencies.

That only makes sense, since we're a service which has almost zero clout. Money talks and poverty walks.

With 150 countries expected to attend, and about 100 of them from third world countries, all in desperate need of more spectrum space, and few with any interest in amateur radio, the cards are stacked against us.

Hopeless? Not if we use the next two years to do more than twiddle our thumbs and hope we don't get hurt too badly.

So, what can you do? What can any one person do? Plenty. And I don't mean getting on the air and kvetching about it.

There's this national American organization, one of whose responsibilities is to protect our frequencies. Well, what better time to see some protective plans going into action?

Here's what I'd do if I were the League General Manager. I'd put together some teams of ham ambassadors to visit the heads of these third world countries — the ones who will be swinging the votes at the coming WRC — and explain the benefits of amateur radio to their country. All we have to do is point to Jordan and the enormous impact amateur radio has had on that country.

In 1970 I heard that King Hussein had been given a ham station by his wife for Christmas. I cabled him, asking if he needed any help in learning the ropes with it. He cabled back to come on over. I did, and spent two fantastic weeks in his summer palace operating with him. He had a ball!

I explained the benefits to Jordan if he'd get his youngsters interested in the hobby — how in the U.S. 80% of the new hams were teenagers and that 80% of them went on, as a result, to high-tech careers. He gathered his government

Continued on page 8

continued from page 1

6. The Amateur is Patriotic. ... His knowledge and his station are always ready for the service of his country and his community.

Seen in the Modulator, *newsletter of The Fort Myers ARC, Inc., Nov. '99.*

Hamvention Awards Announced

The names of ham radio's Emmy and Oscar winners for 2001 are out. This, as the Dayton Amateur Radio Association tells the world the names of this year's Technical Achievement, Specific Achievement, and Radio Amateur of the Year award winners:

George Jacobs lives in Silver Spring, Maryland. His callsign is W3ASK, and the Dayton Amateur Radio Association has chosen him as its 2001 Radio Amateur of the Year.

"I do not want to get emotional over it," said Jacobs, "but it really gratifies me that somebody thought of rewarding me. I don't really feel that what I have contributed to Amateur Radio is as much as I have gotten out of Amateur Radio."

If the name George Jacobs sounds familiar, it should. For the past 50 years — yes — we said fifty years — Jacobs has been bringing propagation forecasting to the world of amateur radio in the pages of *CQ Magazine.* He has also been a contributing editor for *World Radio TV Handbook* for 39 years and has authored hundreds of technical articles which have appeared in print worldwide.

"The truth of the matter is that it ought to be the other way around," W3ASK continued. "I ought to be giving the award to amateur radio for all it has done for me in my personal life and professional life."

There is a lot more to W3ASK than just letting hams and SWLs know where to hunt for DX. In the world of broadcasting, Jacobs is considered to be the engineer's engineer and the consultant's consultant. He is the man whom planners go to when trying to solve the most difficult or impossible RF problems. As such, his contributions to communications technology have furthered the state of the art for over half a century

George Jacobs is in good company with this year's Dayton Special Achievement Award winner. Actually, it's another resident of Silver Spring, Maryland: Frank Bauer KA3HDO.

And who is Frank Bauer, you ask? Well, if you have ever talked to an astronaut on board the Space Shuttle or International Space Station, you have been a part of the world of KA3HDO. Bauer's countless hours of behind-the-scenes work with SAREX — the Space Amateur Radio Experiment — and ARISS — Amateur Radio International Space Station — operations have made these very high profile activities worldwide successes. But in accepting the award, Bauer says that he is only a small part of a worldwide group of volunteers who are dedicated to keeping ham radio in space:

"As I said, I am very humbled to get this award, and I would like to, in particular from my perspective, thank all of the hundreds of volunteers around the world who have made this [ham radio in space] program possible. They put in thousands of hours because they believe in what we are doing in space; they believe in our youth and they believe in Amateur Radio."

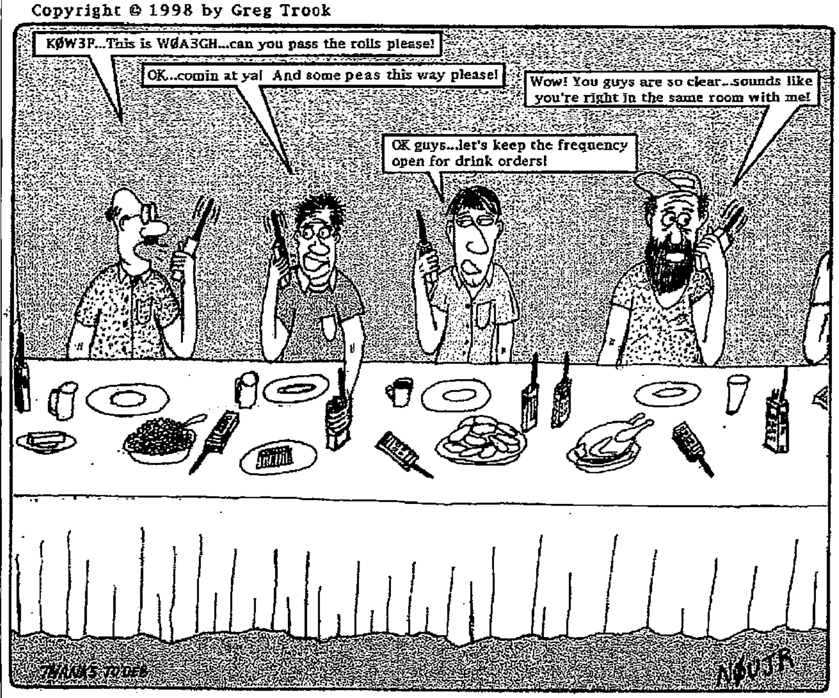
As AMSAT's Vice President for Human Space Flight, Frank Bauer organized the teams that provide the links to schools so that children can talk with astronauts as they orbit the earth. He also developed band plans for spectrum utilization for amateur radio space operations. As an executive, in charge of the Guidance and Control section at NASA's Goddard Space Flight Center, he continues a leadership role as a technical liaison between the Amateur Service and National Aeronautics and Space Administration.

The third big winner at Dayton, the United Kingdom's Peter Martinez G3PLX, has been chosen to receive this year's Technical Excellence Award for his development of a new low bandwidth digital mode called PSK 31 that has taken ham radio by storm.

These days you cannot tune any band without hearing some reference to PSK 31. What makes this mode so unique is its simplicity, its ease of operation, its conservation of spectrum, and its overall reliability. Non-existent just 3 or 4 years ago, PSK 31's unique design has helped revitalize interest in high frequency digital operations.

According to the folks in Dayton, George Jacobs W3ASK, Frank Bauer KA3HDO, and Peter Martinez G3PLX, represent the very best of amateur radio as practiced in the year 2001.

Thanks to Roy Neal K6DUE, via Newsline, *Bill Pasternak WA6ITF, editor.*



At the ham banquet.

Time for a New Hamsat?

AMSAT North America says that it's time to plan for a new generation of ham radio satellites. Operating the next generation of ham radio satellites should be a lot easier. AMSAT NA has announced ambitious plans for a new satellite to be placed into a geostationary transfer orbit at some unspecified future date.

Unlike most of today's ham radio satellites, which move rapidly from horizon to horizon, the new bird will fly a huge ellipse, peaking at about 23,000 miles out in space, then dipping down to a few hundred miles at perigee. Tracking will be easy. The satellite should be in range of ground stations for many hours at a time and it will seem to move very slowly in the heavens.

When you go on the air with the proposed new satellite, you will find transponders for 2 meters,

Continued on page 39

NEVER SAY DIE

continued from page 4

leaders around a big table and had me explain the plan to them and, as a result, ham clubs were set up in youth clubs and schools in every city in Jordan. Three years later I went from one end of the country to the other, meeting over 400 newly licensed hams.

The children of Bedouin sheep herders loved the potential for joining the 20th century and building high-tech skills.

In a more recent visit, Prince Raad JY2RZ organized a special meeting of the Jordanian hams and introduced me as the man who had had more of an influence on Jordan than anyone other than the king.

Surely the League can organize and fund some ham ambassador teams to get out there and sell the product to third world countries. These countries need hams. They need 'em badly. And I'll bet that the League could get some of their member clubs to partner with a third world country to help get ham gear for their school clubs.

The American hams, if asked, could come up with tons of no-longer-used ham gear. When I asked for ham equipment to be sent to Jordan, I received hundreds of donations of gear, all in good operating condition, which I forwarded to the Jordanian Embassy in Washington for shipment to Jordan.

The leaders of every country in the world know that technology is the name of the game. Hopping around, banging drums, doesn't cut it in today's world. With communications and travel getting ever cheaper, even the thirdest of the third world leaders has to come to grips with the Internet and satellites. And that means they need technicians and engineers — which is what ham radio can supply.

But, unless someone gets out there with the message, there's no way the leaders would know about this. If we can get ham radio going in the third world countries we'll have enough clout at WRC to stop the big-buck corporate delegates from fleecing us.

If the League does nothing, be prepared to get sheared again. Say baa.

Money Talks

Just as you are continuing to re-elect your senators and congressmen ensures that they are going to keep digging deeper into your paycheck before you even see it, your continued blind support of the ARRL, no matter what they do or don't do, absolutely guarantees that nothing is going to change. The only voice you have is your membership money. That's your only vote.

The only bright spots on the ham horizon in the last few years were when the FCC finally trashed the League's beloved code barrier to the higher class licenses, and their opening of a no-code Tech license, also vigorously fought by the ARRL. Both brought us brief spurts of new hams. But, in the long run, we either have to promote and advertise the hobby or it is going to slowly blow away. I've been like a broken record about the need for the League to mount a national promotional campaign. Nothing's happened. We members dutifully send in our yearly dues and the Newington Country Club ends up with a lot of it.

Has your club ever demanded a visit from your director? Have you then asked him what the League's plans are to revive our dying hobby? Have you ever threatened him with not renewing your membership if he doesn't get some action?

We should be seeing articles in the national magazines touting our hobby. We should be seeing TV coverage. We should be hearing about it on talk radio. Far's I know, the only hint the public has had about ham radio has been when Art Bell and I have talked about it on his program.

There are thousands of talk radio shows, and they're a great way to get the word around. I love to get on and talk about the fantastic adventures amateur radio has brought me. The hobby has been a key element in my whole life.

It doesn't cost much to mount a very effective publicity campaign. All it takes is some know-how, persistence, and a couple people to make it happen. Heck, I've been doing a good business selling a $40 video I made on how any company can easily generate an extra million dollars in sales just by effectively using promotion. And I go through the process, step by step.

This is something any company or organization can do, and few (if any) are. When I was publishing the first and third largest magazines in the country, I was dealing with the largest ad agencies in the country. Not one of them had a clue as to how to use promotion effectively. Why? That's simple, they get their money from commissions on ads they make and place, not on the sales their campaigns generate. The more free ads they get for a company, the less money the agency makes. Money talks.

If You Can't Talk

Has your ham club ever made the slightest effort to get local publicity? Long ago I recommended that every ham club have a promotional officer whose job was to get notices of club meetings into the local newspapers, on the radio and TV stations, and even onto local store and school bulletin boards.

If you have someone in the club who has the ability to talk — which may be difficult to find, I suspect, gauging from what I hear on the air — get the members to start a campaign to get your talker interviews on radio and TV talk shows. If you have no volunteers, then line me up as a guest. I love talking on these shows, and have no problem with there being millions of listeners. And the listeners love hearing me talk.

The Art Bell show newsletter says tapes of my shows are their best sellers.

Mad Cow Madness

The scare over bovine spongiform encephalopathy (BSE), the Mad Cow Disease, has scared Big Mac attacks out of millions of Americans. Well, that can be a super plus for their health, but, as usual, it's a crock.

Yes, there's a lot of BSE in England; no, it's not likely to be spread to the U.S.

The real cause of BSE has been obscured by the furor over the bonemeal being fed to cattle being cited. However, Cambridge University specialist David Brown's experiments have shown clearly that the real culprit has been the use of phosmet, an organophosphate insecticide used in the British warble-fly campaigns.

Naturally, with millions at stake, the insecticide manufacturers ganged up to discredit the research.

In humans, BSE is called Creutzfeld-Jakob Disease. The clusters of CJD downwind of a British phosmet production plant are hard for scientists to ignore.

Another researcher in the field is scientist and organic farmer Mark Purdey. Purdey, who has been refused any research funding by the British government, has had his house burned down, his lawyer driven off the road and killed, and the veterinarian working with him killed in a car crash — locally reported as "Mystery Vet Death Riddle." Another researcher, Dr. Bruton, a CJD specialist, had just written a paper on the subject when he was killed in a car crash before it could be published.

Will this news make headlines and a TV exposé show, or be plowed under by the affected industries?

Anyone interested can read the whole disgusting story in the March issue of Acres USA.

Now, you can go back to McDonald's or Wendy's and continue killing yourself, only more slowly. Do you want fries with that? Fried in hydrogenated canola oil (rapeseed oil)?

Continued on page 61

Carl Markle K8IHQ
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Clairdon OH 44024-8910

Modular Remote Coax Switch

Build this handy device to save time, money, and XYL yelling.

Have you looked at the price of coax cable these days? Do you have more than one antenna system to feed? Then you just might be interested in this HF remote coax switching system to save time, money, and the XYL screaming about the holes in the wall.

As we know very well, the homes we purchase these days are larger then they were years back. This translates to longer distances between the antenna system and the radio shack. There are two problems that arise from this situation. The first is RF power loss on the coax cable and the cost per foot. Generally speaking, you can ignore the loss along a 200-ft. cable at frequencies below 15 MHz, but there is still the cost-per-foot challenge. If you like to use frequencies from 15 MHz to 30 MHz, then you will have to pay attention to cable losses and the number of one-half wavelengths of distance you have to transverse. This equates to dollars for the premium cable for runs beyond 100 feet. The losses are just too great to ignore. There are plenty of articles and published data for you to understand what this all is about. The bottom line here is that for over 200 ft. at 28 MHz, you will need a 1 kW linear amplifier just to make up for those line losses.

The average cost for general purpose cables like RG-213, RG-8, etc., is about 45 cents per foot, plus the cost of reliable connectors. This is at least $100 per cable run. If you have monoband antennas for 10, 15, and 20 meters, you need at least three runs of coax. If you like to work 160 through 40 meters, then there are three more runs which may run 300 or 400 feet. A guy would have to consider purchasing stock in the coax cable company to be able to purchase this quantity of the stuff!

Anyway, the remote coax cable switch looks pretty good at this point to most people. The cable switch is typical of the switches offered by a couple of companies, including the now-gone Heathkit Company. Most of the models available are 1 of 4 or 1 of 6 types. They use very large open-air 20 amp relays and the type of components used in the 1950s. The price of these commercial switches usually exceeds $125 — not to mention the extra multiconductor cable they need to supply relay switching

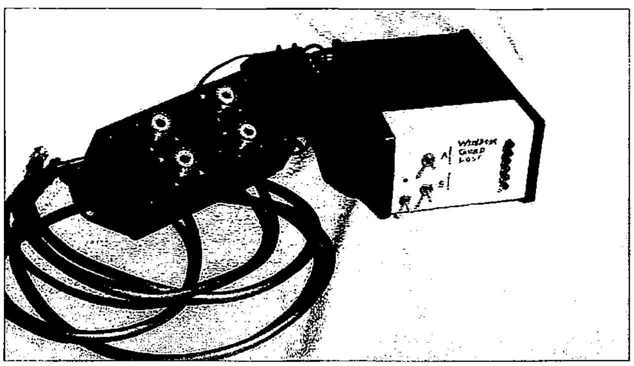

Photo A. *Control and low pass filter.*

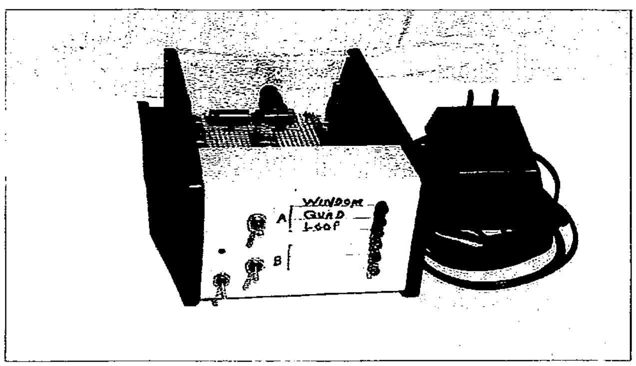

Photo B. *Control internals.*

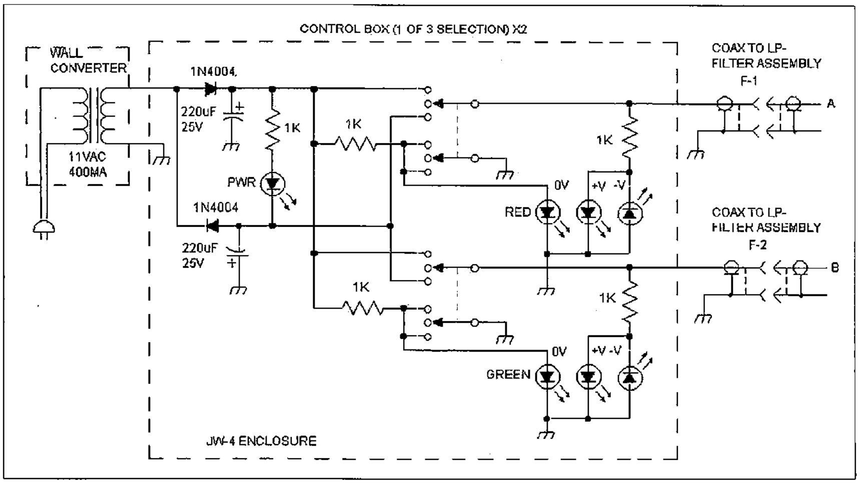

Fig. 1. Control box.

voltages. This article presents a much less expensive do-it-yourself alternative.

My main objective here is to have folks purchase the components from the five sources listed and do a real home-made quality project. When friends come around to see the shack, it is always a source of pride to announce that you built it yourself! It gets the ham out of the appliance operator category. It just plain makes you feel good! I have a complete list of component parts numbers and sources (prices included), which I will be happy to make available to those who provide me with a large SASE.

Qty.	Description
2	Chassis "F" connectors
1	Ten-Tec JW-4 enclosure
1	6-in. x 8-in. (0.1) perfboard, RS #276-1396)
1	11 VAC 400 mA AC wall converter (Hosfelt #56-786)
2	1N4004 rectifier diodes
2	220 µF 25 V electrolytic caps
5	1k 1/4 W carbon film resistors
3	5 mm diffused LEDs, red
3	5 mm diffused LEDs, green
1	Red fault LED (power)
2	DPDT (3-pos.) sub-mini toggle switches (Jameco #138907)
1	Rubber grommet (RS #64-302)
COST = approx. $20	

***Table 1.** Fig. 1 parts list.*

The design of the switch(es) is to provide a 1 of 3 selection on two coax runs. The control is a small, good-looking enclosure designed to occupy a minimum of space on your operating tabletop. The heavy coax cable runs coming from your equipment go to the floor where the low pass filter (LPF) assembly will lie or be physically mounted. This keeps the strain of the heavy cables, four of them, from hauling the control enclosure from your operating table. There are only two 5-ft. runs of very flexible RG-8X running between the tabletop control and the low pass filter enclosures. This cable provides the control voltages which are injected on to the coax cable runs. The low pass filter(s) keep(s) any 1 kW level RF currents from entering the control box. These low pass filters block RF from about 1.8 MHz through

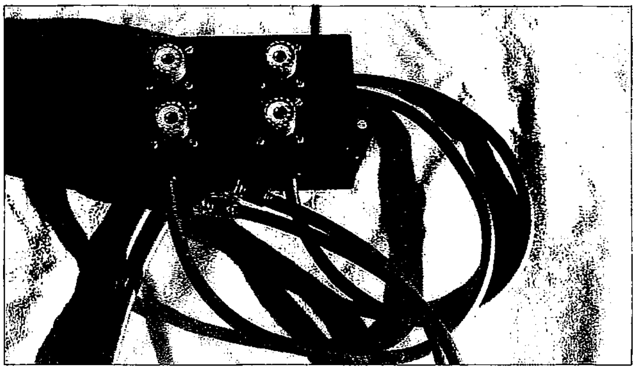

Photo C. Low pass filter assembly.

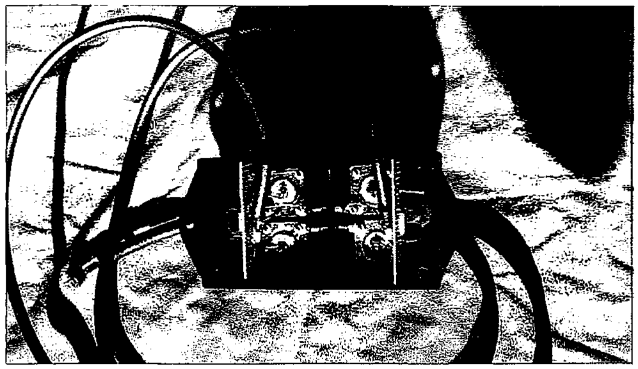

Photo D. Inside view of low pass filter.

50 MHz, yet allow injection of the 12 VDC relay voltage. The two large coax cable runs then leave the low pass filter enclosure to exit the radio shack and go out to the various antenna systems. There are two gray PVC NEC-approved enclosures which will contain the relays and associated components. These switches can be mounted at a central location at the base of the antenna site. If, for example, a three-band quad or a Christmas tree yagi system is in place, then it could be mounted close to the driven elements so that a minimum coax run would be needed from the switch to the driven elements.

So, the complete system is composed of one control box, one double LPF enclosure, and two remote switching boxes. We will take a look at them one at a time and provide an explanation and some information on construction. The assembly is point-to-point solder connections and wirewrap techniques. All of the components are mounted on a perforated board or mounted to the enclosure with clear silicone RTV caulk. The caulk is available from building supply sources at about $ 4 per tube. Most of the tube will not be used, but will be available for other projects used in your home.

The cost of the complete system is about $75 in components and enclosures, as detailed in this article. About $25 could be saved if junk box and less attractive enclosures are used. I wanted sealed good-looking enclosures for my project, so that is why I used a Ten-Tec JW-4 desktop enclosure, Pan-Tec ABS low pass filter enclosure, and $6-each gray PVC NEC-approved outdoors enclosures.

The control box is a Ten-Tec JW-4 enclosure. It provides plenty of room for the hardware and small perfboard used to provide the switching voltages. The power to the box is provided by an inexpensive 11 volt AC wall converter transformer. This item is less than $1.50 and is UL/CSA listed. It is the simplest way to get 120 VAC power to the box to provide the plus/minus 12 VDC for the relays. The relays use about 25 mA and are very state-of-the-art devices. Only two are energized at a time, so the current draw is very small. The wall converter is rated at 150 mA.

The components are mounted and connected as per the schematic **in Fig. 1**. Component placement is not critical. AWG-30 wirewrap wire was used for all hookup in this enclosure. Upon completion of the wiring, a quick test should be conducted to ensure proper operation. With the power on, check to see if the bank "A" red LEDs operate properly. When the selection switch is up, the first LED should light; center position, the second LED; and down position, the third LED. Do the same for bank "B." If all is well, then hook up a DC volt meter to bank "A" output (F-1) and move the selection switch again. Up position (1) gives you a plus 12 VDC out, the middle position (2) has 0 V, and the down position gives you a minus 12 VDC out. If everything checks out, move on to bank "B" output (F-2) and verify it.

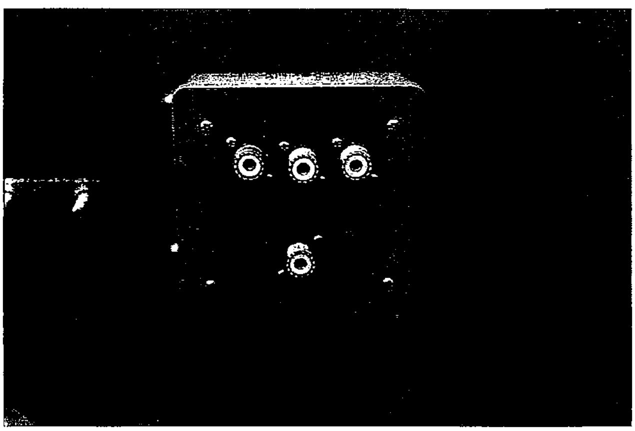

Photo E. Remote switch box.

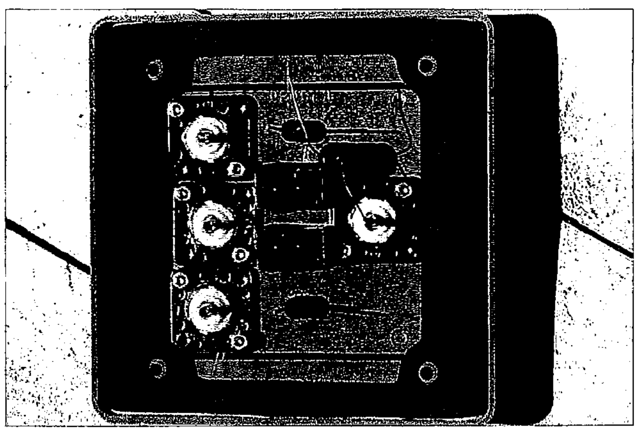

Photo F. Back of switch box.

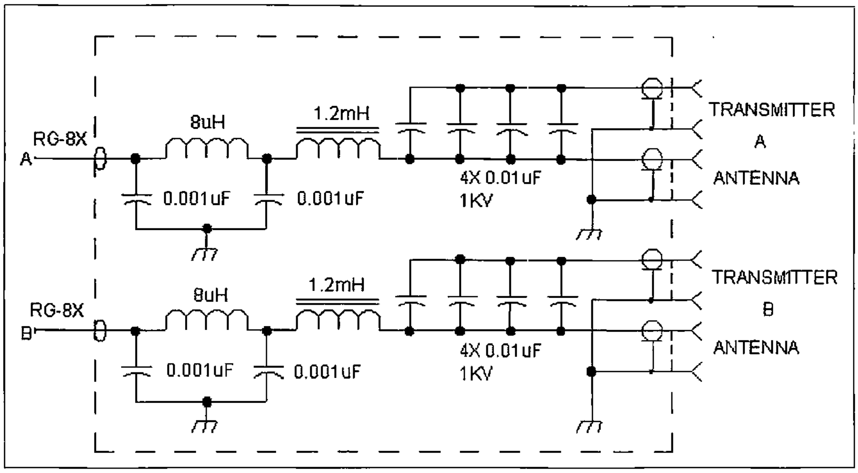

Fig. 2. The complete low pass filter schematic.

Photo G. Remote switch with "N" connectors.

Now that you have a working control box which is the source of your power to operate the relays, we can move on to the low pass filters assembly. The enclosure selected can be purchased from your local Radio Shack store for about $4. It is made of ABS black plastic and has an aluminum cover held on by sheet metal screws. The box is attractive because it has side mounting ears and internal perfboard slots, to hold the perfboard assembly in place without adhesive or hardware. The component placement on the two small perfboards is not critical; however, I did try to make the large RFC lead close to the SO-239 coax connector for soldering. Refer to **Fig. 4** for recommended placements. The complete schematic is shown in **Fig. 2**. Notice that four .01 µF 1 kV capacitors are used to make up the 0.4 µF 1 kV RF bypass capacitor. This capacitor blocks the DC relay voltage from entering any of the equipment, yet allows the 1 kW RF to bypass on to the coax and antenna system. The enclosure requires four 5/8-inch-diameter holes to be drilled for the SO-239s. I used a

Qty.	Description
1	Pantec FLX-T4624 box (RS #RSU1165810)
2	2.3-in. x 4.4-in. perfboard
4	0.001 µF 50 V ceramic caps
4	SO-239 coax connectors
2	1.2 mH 250 mA RF chokes (Mouser #43LH212)
2	8.2 µH RF chokes (Mouser #43LQ826)
2	Rubber grommets (RS #64-302)
10 ft.	RG-8X coax (flexible)
16	#2 nuts/screws/lockwashers
8	0.01 µF 1 kV ceramic cap (Jameco #97375)

COST = approx. $10

Table 2. Fig. 2 parts list.

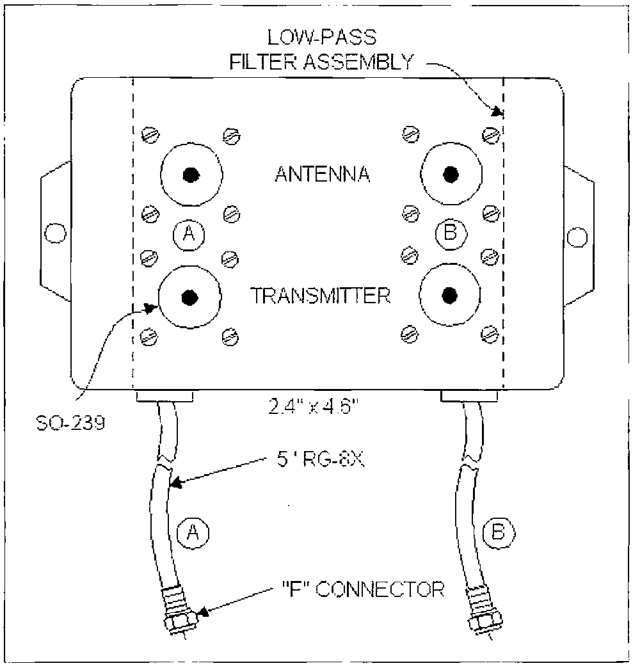

Fig. 3. Low pass filter(s).

Forstner drill bit for this task, which made a perfectly clean hole. This would not be the case if using metal twist drill or spade bits. The mounting hardware is #2 screws/nuts/ lockwashers. See **Fig. 3**.

When the control box to low pass filter is attached using the "F" connector cables, a quick DC Voltage check can be made to ensure that control voltages are present at the SO-239 coax connectors that go to the two antenna systems. When verified, you can move on to the remote switch boxes. In my version the two lower SO-239s are for xcvr connections and two upper SO-239s are for the antenna system coaxes.

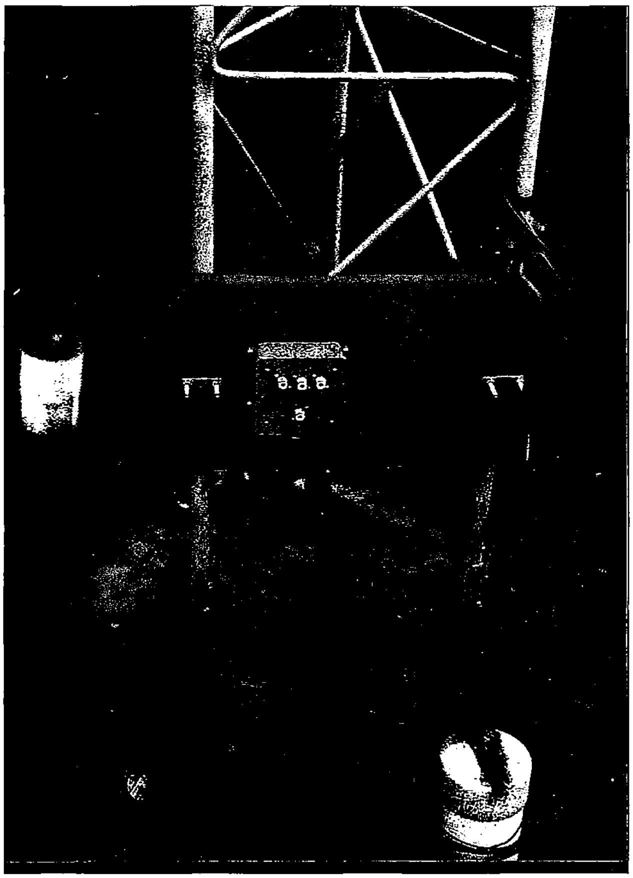

Photo H. *Tower mounting*

Now, for a little background on the antenna switch box circuit. See **Fig. 5**. Note that two 5mm LEDs are used to ensure that only the proper polarity will operate the intended relay. The relays are polarized and nitrogen-filled 5 amp DC types, which can handle RF quite well. DO NOT attempt to substitute other relays for these. It took me quite a while to find suitable relays for 1 kW (SSB/CW) operation. They must be DPDT construction with magnetic bias to provide the low current and RF switching capabilities.

When the switch box is mounted, you can look out the window after dark and watch the switching taking place. This is always a good feeling to be able to see that it really is happening! See **Fig. 5** for the placement of components. The relays are RTV-glued to the PVC lid of the 4x4 NEC box. The box is mounted but has no components inside. All components are mounted on the lid so as to provide easy access for repair on an inside workbench if ever necessary. I just don't like that outside work in the snow and cold! Use AWG-14 wire for all RF interconnects. The switching circuit can be wired with AWG-24 or other light gauges. The gas discharge device is optional; however, it is nice to know that a 600 V/2 nS gas device is there to prevent static charge buildup on the antenna from creeping down the cable to this switch unit. It is well worth its $1.25 price tag!

Remember, there is no DC continuity between the SO-239s and the input SO-239, because there is a .04 µF 1 kV blocking capacitor in place. Testing amounts to checking LED indications. If it is felt to be necessary, jumper around the blocking capacitor and do your DC voltage tests at the appropriate SO-239s. The final test is to hook up a dummy load and check with RF looking at the SWR of the coax cable system.

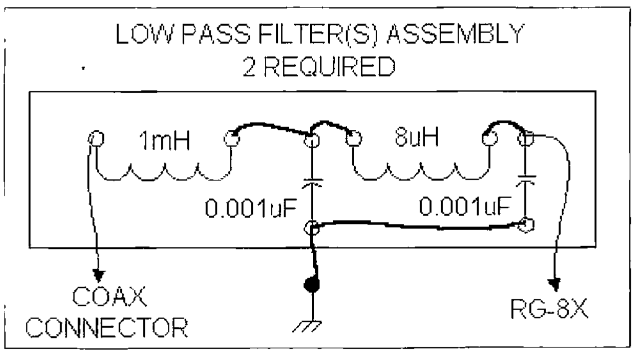

Fig. 4. Low pass filter(s) assembly. Note: Box has slots to hold perfboard.

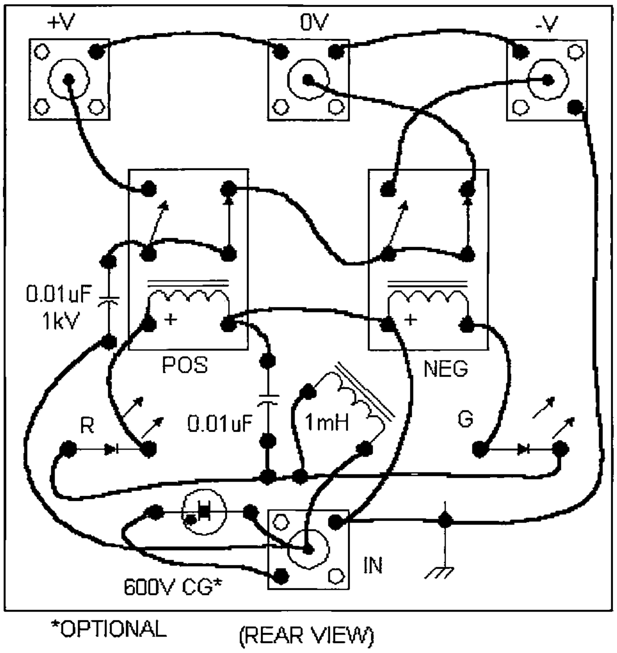

Fig. 5. Remote coax switch(es). Note: Do not substitute relay types. Aeromat DSPIM-12 V only!

In summation, I can highly recommend this unit. It will provide quite a savings on coax, or entice you to purchase some of that expensive premium cable. I use a special semi-hard RG-6 equivalent which runs 500+ ft. to a 1000 ft. loop antenna system, without any noticeable losses, even at 28 MHz. This is a special Teflon-type cable, but it would not make a difference at the 15-MHz-and-below design criteria. Another item to be noted is that the gray PVC enclosures have a one-half-inch opening at the bottom of the enclosure. I used an old wine bottle cork to plug it up. Venting did not seem to be necessary.

Qty.	Description
4	SO-239 coax connectors (Hosfelt)
1*	600 V gas device (Mouser CG-600)
4	0.01 µF 1 kV ceramic caps (Jameco # 97375)
1	0.01 µF 50 V ceramic cap (Jameco #15229)
1	1.2 mH 250 mA RF choke (Mouser #43LH212)
2	Aeromat DSPIM 12 V relays 5 amp (Digi-Key #255-1047)
1	Red LED, 5 mm
1	Green LED, 5 mm
1	4-in. x 4-in. PVC enclosure (Carlon #E9802CN)
1	4-in. x 4-in. PVC blank lid (Carlon #E9802CN)
*Optional	
Note: Do NOT substitute relay types — Aeromat DSPIM 12 V only!	
COST = approx. $21 each	

Table 3. Fig. 5 parts list.

Continued on page 58

Howard Foreman KC7IZH
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Vancouver WA 98682
[hforeman@pacifier.com]

"How High's the Water, Mama?"

The story of a packet public service project flooded with success.

These words from country-and-western singer Johnny Cash's 1960s song are still heard here in the state of Washington, as they are elsewhere around the country. Many times during flood season, the Clark County ARES/RACES group helps out with monitoring various stream levels in the county's key tributaries. Monitoring the tributaries gives the county emergency planners up-to-the-minute data to make key decisions on manpower and materials during emergency periods of extreme rain or melt-off, and resultant flooding.

Normally, this requires several dedicated volunteers in "round the clock" shifts trudging out in the rain every 15 minutes to manually read stream gauges. In the fall of 1998, Zeph McNaughton N7WAP and his wife, Jan KB7OKG, worked with the county to identify all the locations that would need to be monitored; they developed a handbook showing which locations had stick gauges, where to park for observation, what equipment to bring, and what to expect at each location. **Photo A** shows a typical installation site.

Zeph brought the problem to the local packet group, which led to a brainstorming session about how to reduce the amount of manpower required for this operation. Miles Bond AB7ZX, as the new head of the packet group, coordinated efforts and provided encouragement, cajoling, coffee, and cookies, as required. It was felt this would be an ideal opportunity to demonstrate the benefits of Unmanned Radio Telemetry. In developing the criteria for a stream-level monitoring device, it was decided that a semi-permanent unit was needed that could be placed in service for an extended period of time. Recommendations from the county (and past experience) indicated that they would want to know levels of streams in approximately a ten-foot range, in increments of 0.1-foot. It was also felt that some method of monitoring battery voltage would be advantageous. Of course, cost was also to be a major factor in all choices.

At first, the county had indicated that it would install wells that were connected by culvert at the bottom of the stream bed. In practice, we eventually ended up with a "bulb housing" for our measuring device.

The packet group met, and the process was broken down into its individual components, according to expertise. **Fig. 1** shows a block diagram of our solution.

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Digital telemetry

The Kantronics KPC-3 Plus Packet Terminal Node Controller (TNC) was the obvious choice for transmitting water level and battery voltage via packet radio. John Fletcher KB7FND was by far the most experienced of the group in sending telemetry data streams (channels) via radio using the standard Kantronics KPC-3 Plus™ TNC. Most of the TNC discussion revolves around this newer version of the venerable KPC-3 Plus TNC. This

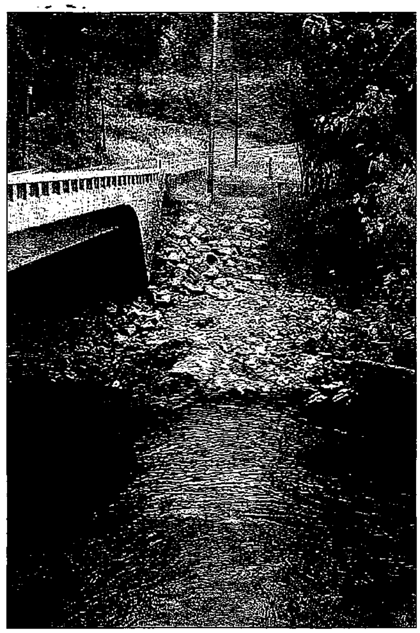

***Photo A.** Installation site.*

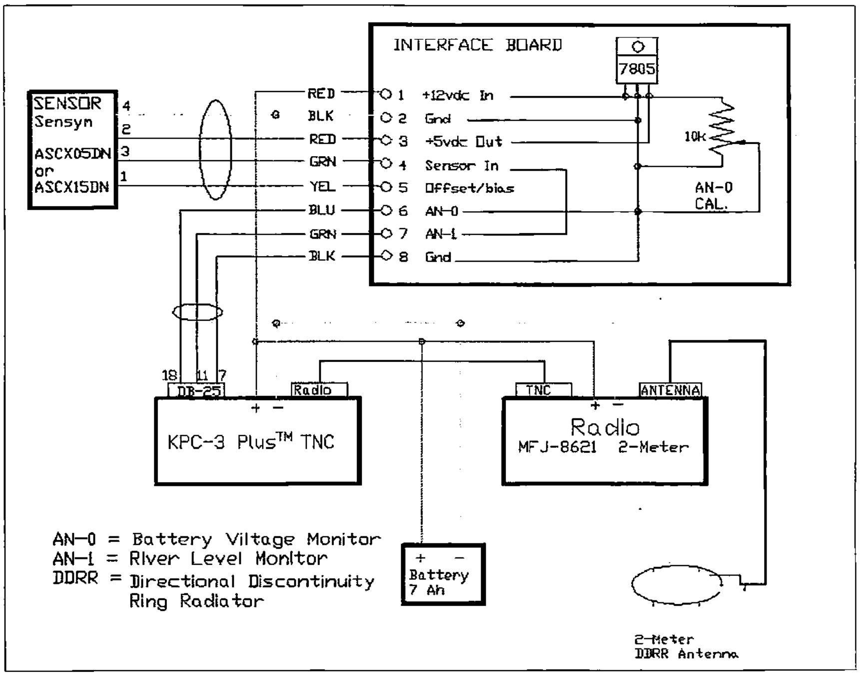

Fig. 1. Block diagram of river gauge station.

would enable each of the sensors to be relatively low-power by using the digipeater feature of the KPC-3 Plus to pass the data as packet messages in relay fashion until it reached the proper monitoring station. John emphasized that the signal from the sensor to the KPC-3 Plus unit needed to be in the 0.0 to 5.0 VDC range. This turned out to be the limiting design criterion, meaning that every design decision of the metering device would be based upon this factor. Since there are two analog input channels available on the KPC-3 Plus, we would be able to monitor stream levels and battery voltage concurrently.

The KPC-3 Plus has two channels available, labeled AN0 and AN1. It accepts the analog input of 0–5 VDC and converts it to a decimal count in the range of 000 through 255. This equates to 0.0196 VDC per count.

John outlined many of the features of the KPC-3 Plus that would be used to our advantage in this experiment. As these units will be powered by gel-cell battery (with a minimum of 72 hours' battery life as the goal), power consumption and its conservation will be refined to the limits — even the status LEDs may be turned off for low power consumption.

The more predominant feature will be the remote programmability of the unit. This will enable the group to change the "sampling rate" from, say, 15 minute intervals to shorter intervals, such as every 5 minutes. Since all the parameters stay in memory due to the internal lithium battery, this will enable the initial programming to be accomplished "in house" and not out in the field.

John displayed a standard DB-25 jumper connection box that will enable the analog signals to be introduced to the units in a reasonable fashion. An interface box will also be needed to hold a small PC board that will house the 5 VDC regulator (7805) that supplies power to the sensor and the small 10k potentiometer that will be used to drop the voltage of the battery *proportionally* down to the 0–5 VDC range required by the KPC-3 Plus. This normally requires the resistance to be in the neighborhood of 3.33k, which provides 0–15 volt range (read as 0–5 V by the TNC). At this point, we must remember that as a rule of thumb, 9.6 volts is the "deep cycle discharge point" of a normal gel-cell; any lower, and the battery may be damaged. The display software was programmed to

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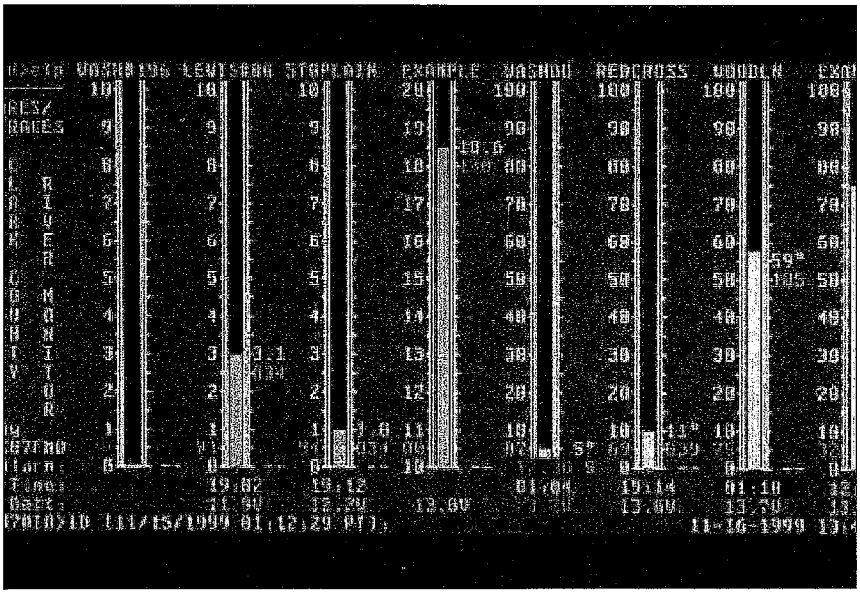

Photo B. *Screen monitor.*

alarm at 11.0 volts to trigger attention to that particular unit.

Transceiver

While a plain beacon-type transmitter would work in this application, it was felt that a transceiver would be advantageous, as this would afford the group the ability to remotely program the TNCs — especially the sampling rate. An MFJ-8621 2-meter 5-watt radio, crystalled on the club's packet frequency, would give us the ability of digipeating the data across the ARES packet network. It is also understood that the internal clock will enable the TNCs to be programmed so as not to double on transmissions with another sensor.

Packet telemetry

The KPC-3 Plus has two analog input ports that are connected to its processor's analog-to-digital (A/D) converter. Each analog quantity (0 to +5 VDC) is digitized into an 8-bit binary number, which in turn is converted by the TNC's software to a decimal number in the range of 000 to 255. The decimal number for each of the two analog inputs is then inserted into a special telemetry beacon and transmitted at a user-defined interval (10 seconds to 42.5 minutes). This transmitted beacon can be digipeated by other packet stations in the region, allowing the use of a low power transmitter at the measurement site. A number of local ARES/RACES members have set up their home packet stations to perform this digipeating function to provide coverage throughout the county. The beacon will be in the following format:

KC7IZH-12>BEACON, RELAY, WIDE* [11/08/1999 22:05:32 PT]:
T#320,235,047,043,056,125,00011001

In this example, the first analog quantity is decimal 235 and the second is decimal 047, representing analog voltage inputs to the TNC of 4.0678 volts and 0.9216 volts respectively. Each decimal count represents 0.0196078 volts (5.0 volts divided by 255 count). The "T#320" is the telemetry beacon cycle number. Each time the telemetry beacon is transmitted, this count is incremented. The count starts out at 000 when the TNC is powered up. When the count reaches 999, it rolls over to 000. By keeping track of this number, the display software can determine if a beacon was missed. The display software also uses this number to eliminate multiple beacons received from more than one digipeating station.

Then the data from each sensor will be collated in a tabular format and converted to depth by the software at the designated monitoring site. Again, John KB7FND demonstrated a DOS-based program written in BASIC. While this could be done with any of the more current versions of BASIC, John reminded the group that this task could well be relegated to a "scrounged" MS-DOS PC. Also, the major difficulty of convincing Win95/98 to relinquish one of its Comm Ports may be avoided. The graphical screen was laid out in bar-graph format with 8 channels displayed on the (first) screen. Each bar has a resolution of 0.25-foot, with the digital figure in tenths next to the level bar. Programmed into each bar display is a red mark, denoting flood stage at that location. Associated with each bar is an F-key. With the touch of the respective F-key, a new screen is opened up to display that particular sensor's history over the past 24 hours in a line-graph display. The bar colors were green on a blue background. It was suggested that the planned user-preset alarm level should turn the bar red to alert attention to the alarm condition. **Photo B** shows the software display.

Another feature in our beta software is the ability to monitor temperature in the same format as levels. This demonstrates not only the flexibility of the setup, but other possibilities available as well.

It was felt that only the raw data need be logged to disk for later trending analysis.

At the bottom of each bar is the last reporting time with the corresponding battery voltage. This would allow the monitoring (duty station) to alert a particular team of a low battery in need of a change-out. Programming will change the numerical value to red should the voltage drop below 11.0 VDC.

Additionally, the software will be monitoring the time and cycle stamp of each transmission. With this, we can disregard any duplicates as a result of digipeating. We will be able to monitor "lost" readings of a nonreporting station if the cycle numbers aren't numerically continuous.

Display stations (using a PC and appropriate software) can be set up anywhere in the county to monitor the

water level and battery voltage of each measuring site. The software program can display up to eight sites in "gauge" form, or the operator can select a graph form that plots the previous 24 hours of collected data for a selected site. Alarm points can be set for each site to sound an audible alarm when the water level or rate of rise reaches a critical value. Another alarm sounds when the battery voltage drops below 11.0 volts. Each display station needs only a receiver on the packet frequency (a scanner will do) and any TAPR-2–style TNC to receive and display the transmitted beacons. The following parameters need to be set in the receive TNC in order to output the above format.

DAYTIME (date/time in the format of YYMMDDHHMM[ss]; seconds optional)
HEADERLN ON
MON ON
MSTAMP ON

An additional feature of the KPC-3 Plus series of TNCs is the ability of the packet SYSOP to change the TNC's parameters remotely. The telemetry beacon interval is one of the parameters that can be changed. This allows the SYSOP to remotely change the interval at a particular site as stream conditions change. The longer the interval, of course, the longer the battery life at the measurement site. Tests have shown that a 7 Ampere-hour (Ah) battery can power a site (5-watt transmitter) for five days at a beacon interval of 30 minutes before reaching a battery voltage of 11.0 volts. This is well above the deep discharge point. Additional battery capacity can be added to extend the reporting life of a station.

At the transmitting station, the following KPC-3 Plus parameters must be set:

MYCALL (station call)
MYREMOTE (remote call)
TELEMTRY 180 (1800 sec) (beacon interval of 30 min., for example)
RTEXT (remote password text – see manual)
UNPROTO (set the digipeat path[s] here)

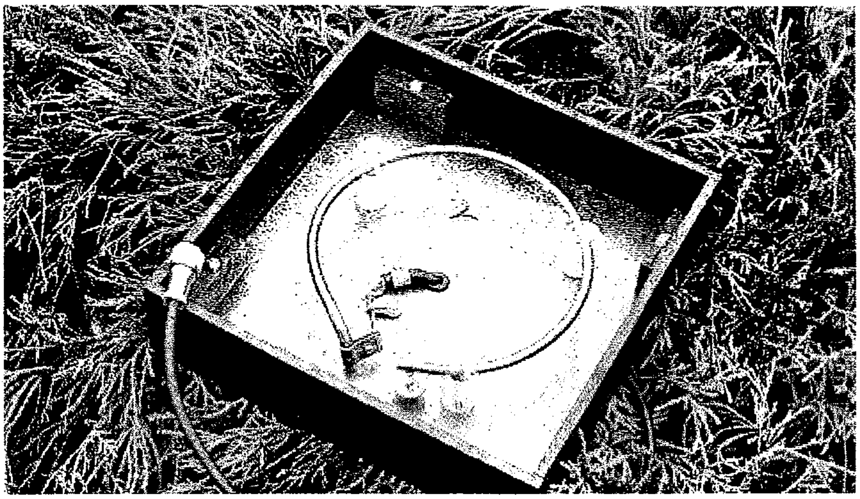

Photo C. Directional Discontinuity Ring Radiator antenna.

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Interface board

An interface board makes up the final part of the station package. As shown in **Fig. 1**, the 12 volt battery output is dropped and regulated to +5 volts for the input to the pressure sensor. Output from the sensor is connected to the TNC analog input AN1.

A 10 k-ohm trimmer scales the battery voltage measurement by one third, making it suitable for the TNC analog input, AN0.

Antennas

The packet group felt that a simple antenna would be needed that would be tamperproof and withstand the rigors of northwest weather. One suggestion was that some sort of antenna (dipole or fractal) would be fashioned and "potted" in an epoxy resin for protection against the elements and curious fingers. Another idea would be to trace/etch some sort of folded dipole or yagi onto a blank sheet of PC board. It was felt different antennas would be needed for each of the varied installations.

Initially, our test sensor will use a cheap mag-mount antenna mounted to the metal cover of the standpipe. Another option used was a low profile "Directional Discontinuity Ring Radiator" (DDRR) antenna (see *The ARRL Antenna Book*) shown in **Photo C**. This particular antenna was used to showcase some of the more imaginative designs available today. A 2-meter version of this low-profile antenna was

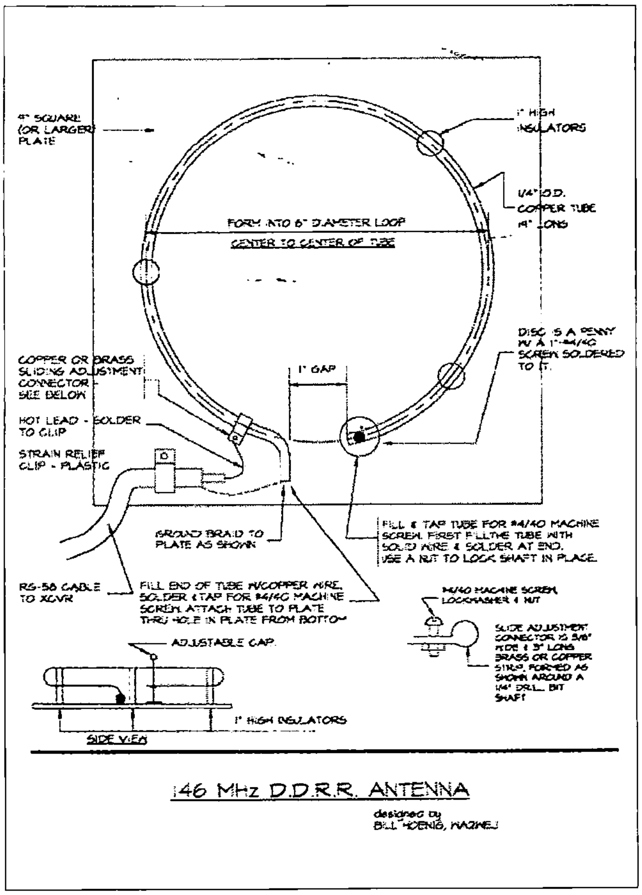

Fig. 2. 146 MHz D.D.R.R. Antenna.

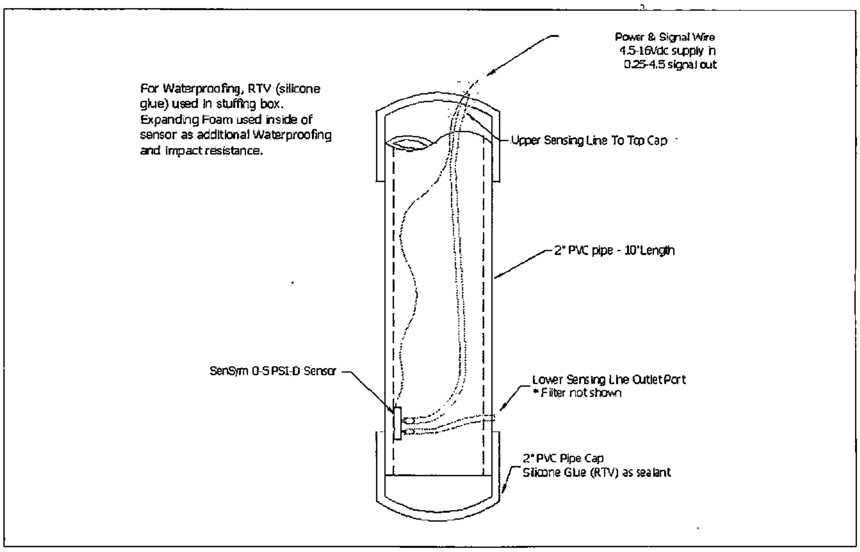

Fig. 3. Sensor capsule. For waterproofing, RTV (silicone glue) was used in stuffing the box. Expanding foam was used inside the sensor for additional waterproofing and impact resistance.

mounted on top of the metal enclosure that houses the electronics; it was covered with a plastic radome. Construction details for the antenna are shown in **Fig. 2**.

Mechanical sensor

Many designs were discussed, such as floats, potentiometers, pulleys, and magnetic relays. I was familiar with this field, and offered to do a bit of research into any other options. Using either relays or magnetic reed switches would require the use of some sort of float assembly. This type of sensor, while being accurate, is prone to clogging and binding when placed out in the "field" among the elements (Murphy's corollary). With the advent of solid state pressure transmitting devices, this offered another avenue for investigation.

Buying something ready-made off the shelf was entirely out of the question, as costs quoted were in the four figure range! However, further investigation led to the discovery of the SENSYM company and their family of inexpensive pressure transducers. More important to our purposes was their *differential pressure* transducer in the 0 to 5 PSI range. The sensor measures the *difference* between the pressure at the two tubing connections. These sensors will run on DC voltage from 4.5 to 16 volts and their output signal is linear between 0.25 and 4.5 volts, exactly what we needed. These are available from Digi-Key at $48 singly or $35 in batches of ten.

If you are wondering why I am discussing a *pressure* transducer to measure depth of water, a short discussion in fluid mechanics is needed to clarify the problem:

Pressure at depth is related to the vertical height of the fluid above the measuring point and its specific gravity. In fluid dynamics, this is referred to as "head." Pressure is linear and directly proportional to depth or head. Mathematically this is expressed as SPECIFIC WEIGHT x HEIGHT. Head pressure is not related to the amount of water in containment, only to the depth of liquid in that container.

Try to visualize a one square inch column of water one foot high. If you could magically turn this column to Jell-o and stand it upright on a scale, it would weigh .433 pounds. Remember that our column is only ONE SQUARE INCH, so we have .433 pounds per square inch. We can verify this by converting the weight of one cubic foot of fresh water (62.4 pounds) to that weight per square inch at its

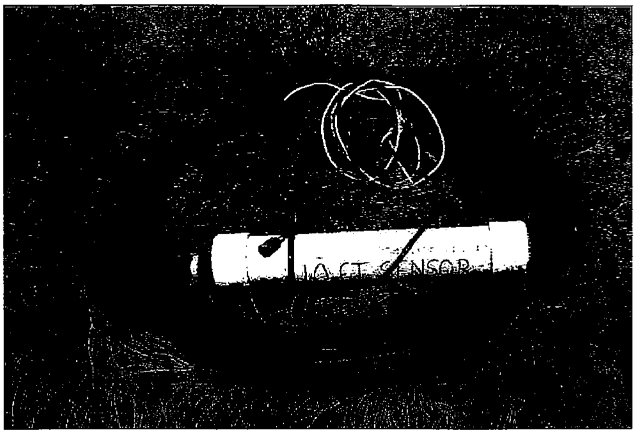

***Photo D.** Here is the sensor capsule, all ready for placement.*

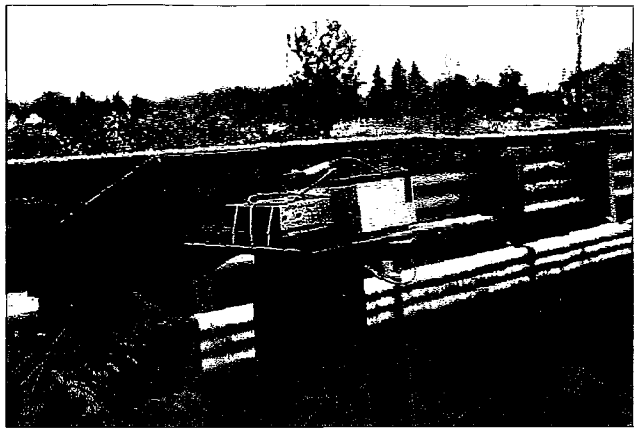

***Photo E.** Photo of the unit in place.*

bottom. Since there are 144 square inches in a square foot, dividing 62.4 pounds of water by 144 square inches yields .433 pounds per square inch. So, to apply this to our purpose, we merely generate a table of HEIGHT OF FRESH WATER VS. PRESSURE and we can use this table to calibrate our measurements. Thus, 0-5 PSI should give us the range of 10 feet we desire (10 feet of Fresh Water = 4.33 PSI). We will use a DIFFERENTIAL pressure gauge so that we can SUBTRACT the weight of the AIR on top of the water (14.7 PSI). This will eliminate any error that would otherwise be introduced related to changes in barometric pressure.

Qty.	Part	Source	Cost
1	Sensym 0–5 PSID gauge	Digi-Key	$48.00 + s/h
1	10-inch length 2-inch PVC sched 40	Hardware store	.75
2	2-inch PVC cap	Hardware store	.89
1	Roll 1/4-in. x 100 ft. drip sys. tubing	Hardware store	5.99
1	Roll 1/2-in. x 100 ft. drip sys. tubing	Hardware store	12.00
1	Pkg 1/4-in. barb connectors	Hardware store	4.49
1	Silt stopper — "aquarium stone"	Aquarium or pet store	1.00
1	3-leg voltage regulator (7805)	Hardware store	3.00
1	25-turn trimpot	Electronics store	3.00
	Acrylic for antenna cover	Hardware store	12.00
1	Roll copper tubing for DDR	Hardware store	12.00
12	1/4-in. tubing clamps	Hardware store	3.00
6	Padlocks	Hardware store	35.00
1	7 Ah gel-cell battery	Your choice	23.00
Misc.: plugs, wire, connectors, assorted screws, RTV, PVC cement, acrylic glue, expanding foam			
1	Model 8621 Data Radio	MFJ	125.00
1	KPC-3 Plus TNC	Kantronics	130.00

***Table 1.** Parts list.*

We will need a waterproof, semi-rigid enclosure that is easily and cheaply constructed. PVC pipe with the proper I.D. dimensions (2") was found to be the best choice. Also, it was felt prudent to fabricate some sort of silt/debris guard to protect the 1/4" tube lower sensing line. A simple porous stone air bubbler from the pet store aquarium department was chosen as offering good surface area with the possibility of some "self-cleaning" characteristics. Ideally, a larger diameter pipe could be attached over the lower sensing end with horizontal "slits" cut at intervals to reduce debris and maintain good water flow. We also thought of reducing the upper portion of the sensor to 1", but felt that the added rigidity of the 2" PVC afforded the cheapest and easiest structural stiffness. A porous stone filter will also be added to the upper or atmospheric sensor to repel any debris or homeless insects.

Our first design was a long column of 2" PVC pipe to be lashed or strapped to the bridge column. Unfortunately, when the prospective bridge sites were initially surveyed, they were free span bridges with no upright column supports rising from the water. So, back to the drawing board, and it was decided to reduce the design to a waterproof "capsule" to protect the sensor. The final design is shown in **Fig. 3** and **Photo D**.

This left only the 1/4" tubing and the four conductor wires exiting the sensor "capsule" to be led through a 1/2" drip irrigation tubing in a shallow trench up to the radio/TNC box. Remember, one of the lengths of tubing must be in the atmosphere at all times. The "capsule" was anchored with a duckbill anchor, which works similarly to how a lag bolt or screw works. This will ensure that our sensor won't be floating away anytime soon.

The county did the trenching, installation, and backfill of the sensors. They also provided the radio box enclosures fabricated from steel. Miles AB7ZX supervised the radio/TNC installations, with John KB7FND doing the on-site wiring and fine tuning. A few minor troubleshooting problems were ironed out within the first week of "shakedown" operation. The radio required fine-tuning for maximum signal sensitivity with minimum power consumption. **Photo E** shows the final installation.

The ultimate goal of this project is to be able to correlate stream height

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73 Review

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Kenwood's Hot New TS-2000

Could YOU handle all these features?

I recall several years ago when I made a prediction that the Trio Corporation would eventually consider the Kenwood Communications amateur product line a rounding error in the grander scheme of things, and we would have one less manufacturer of ham gear to draw from. MAN, was I ever wrong! Not only has Kenwood not disappeared, but they are extending the state-of-the-art of amateur radio products in an aggressive way. The new TS-2000 is vivid proof of that.

I will confess to you that I was a bit excited when I heard about this product. When Dave N7KZN called me to let me know that the first TS-2000 to hit the state of Washington was on his counter at Radio Depot in Seattle, I made the 25-mile trip from my QTH in less than 30 minutes. After a brief period of manhandling the controls, I decided to give it a new home.

Having said that, however, I want to assure you that what follows is a purely objective review of this new offering from the good folks at Kenwood.

General overview

From a functional standpoint, the TS-2000 is two transceivers in one box. It is an HF transceiver that incorporates many of the features of the TS-570 and the TS-870 (while adding a few of its own), as well as a variation of the multifaceted TM-D700A. Its delineation is not quite that simplistic, however. The TS-2000 is a complex matrix of transceiver components that allows it to operate as two independent radios in one box. It can allow the user to operate on HF and either VHF or UHF simultaneously, which is something that recent offerings in the arena of 160m to 70cm all-mode radios cannot currently do. It also has the capability of operating as a full-duplex VHF and UHF transceiver for the purpose of working the OSCARs, or similar applications. What is truly unique is the on-board packet TNC that was borrowed from the TH-D7G, which has the ability to transfer data over the air at selectable rates of 1200 and 9600 bps. **Tables 1** through **4** show the general specifications of the TS-2000.

Physical characteristics

Kenwood has listed a number of distinctive features in their promotional literature. However, it is my opinion that they have overlooked an important feature that definitely adds value from a consumer perspective: ruggedness. The box that houses the electronics is an aluminum casting. The fasteners are of a good quality, and the machine work is very high-caliber. When viewed in comparison to some radios that come in a thin-walled, spot-welded enclosure, the TS-2000 has extraordinary structural integrity.

The front panel is a stylistic ergonomic design. I found that everything was easily accessed, and functionally

Photo A. *This is the front view of the stylishly new Kenwood TS-2000 — a true work of art. (Photo compliments of Kenwood)*

Receiver			TS-2000 TS-B2000	TS-2000X
Sensitivity	SSB/ CW/ FSK (S/N, 10 dB)	Main	0.5 ~ 1.705 MHz: 4 μV or less 1.705 ~ 24.5 MHz: 0.2 μV or less 24.5 ~ 30.0 MHz: 0.13 μV or less 50.0 ~ 54.0 MHz: 0.13 μV or less 144 ~ 146 MHz: 0.11 μV or less (All E-types) 144 ~ 148 MHz: 0.16 μV or less (K-type) 430 ~ 440 MHz: 0.11 μV or less (All E-types) 430 ~ 450 MHz: 0.11 μV or less (K-type) 1240 ~ 1300 MHz: 0.11 μV or less (All types)	
	AM (S/N 10 dB)	Main	0.5 ~ 1.705 MHz: 31.6 μV or less 1.705 ~ 24.5 MHz: 2.0 μV or less 24.5 ~ 30.0 MHz: 1.3 μV or less 50.0 ~ 54.0 MHz: 1.3 μV or less 144 ~ 146 MHz: 1.0 μV or less (All E-types) 144 ~ 148 MHz: 1.4 μV or less (K-type) 430 ~ 440 MHz: 1.0 μV or less (All E-types) 430 ~ 450 MHz: 1.0 μV or less (K-type) 1240 ~ 1300 MHz: 1.0 μV or less (All types)	
	FM (12 dB SINAD)	Main	28.0 ~ 30.0 MHz: 0.22 μV or less 50.0 ~ 54.0 MHz: 0.22 μV or less 144 ~ 146 MHz: 0.18 μV or less (All E-types) 144 ~ 148 MHz: 0.25 μV or less (K-type) 430 ~ 440 MHz: 0.18 μV or less (All E-types) 430 ~ 450 MHz: 0.18 μV or less (K-type) 1240 ~ 1300 MHz: 0.18 μV or less (All types)	
	AM (S/N 10 dB)	Sub	144 ~ 146 MHz: 1.55 μV or less (All E-types) 144 ~ 148 MHz: 2.25 μV or less (K-type) 430 ~ 440 MHz: 1.55 μV or less (All E-types) 438 ~ 450 MHz: 1.55 μV or less (K-type)	
	FM (12 dB SINAD)	Sub	144 ~ 146 MHz: 0.28 μV or less (All E-types) 144 ~ 148 MHz: 0.40 μV or less (K-type) 430 ~ 440 MHz: 0.28 μV or less (All E-types) 438 ~ 450 MHz: 0.28 μV or less (K-type)	
Selectivity	SSB (Low-cut: 300 Hz/ Hi-cut: 2600 Hz)	Main	–6 dB: 2.2 kHz, –60 dB: 4.4 kHz	
	AM (Low-cut: 100 Hz/ Hi-cut: 3000 Hz)	Main	–6 dB: 6.0 kHz, –50 dB: 12.0 kHz	
	FM	Main	–6 dB: 12.0 kHz, –50 dB: 25.0 kHz	
	AM	Sub	–6 dB: 12.0 kHz, –50 dB: 25.0 kHz	
	FM	Sub	–6 dB: 12.0 kHz, –50 dB: 25.0 kHz	
Image rejection	Main transceiver		70 dB or more	
	Sub-receiver		60 dB or more	
1st IF rejection	Main transceiver		70 dB or more	
	Sub-receiver		60 dB or more	
Notch filter attenuation (at 1 kHz)			30 dB or more	
Beat cancel attenuation (at 1 kHz)			40 dB or more	
RIT shift frequency range			±20.0 kHz	

Table 1. Receiver performance specifications. Source: Kenwood Service Manual.

Receiver		TS-2000 TS-B2000	TS-2000X
Circuit type	Main tranceiver	SSB/ CW/ AM/ FSK: Quadruple conv. superheterodyne FM: Triple conversion superheterodyne	
	Sub-receiver	FM/ AM: Double conversion superheterodyne	
Frequency range	Main transceiver	0.03 ~ 60.0 MHz (All types) 142 ~ 152 MHz (K-type) 144 ~ 146 MHz (All E-types) 420 ~ 450 MHz (K-type) 430 ~ 440 MHz (All E-types) 1240 ~ 1300 MHz (w/ UT-20)	0.03 ~ 60.0 MHz 142 ~ 152 MHz 420 ~ 450 MHz 1240 ~ 1300 MHz
	Sub-receiver	118 ~ 174 MHz (K-type) 144 ~ 146 MHz (All E-types) 220 ~ 512 MHz (K-type) 430 ~ 440 MHz (All E-types)	118 ~ 174 MHz 220 ~ 512 MHz
Intermediate Frequency (IF)	Main transceiver	1st IF 0.03 ~ 60 MHz: 69.085 MHz or 75.925 MHz 118 ~ 512 MHz: 41.895 MHz 1240 ~ 1300 MHz: 135.495 MHz 2nd IF: 10.695 MHz 3rd IF: 455 kHz 4th IF: 12.0 kHz	
	Sub-receiver	1st IF: 58.525 MHz 2nd IF: 455 kHz	

Table 2. Receiver operational specifications. Source: Kenwood Service Manual.

well organized. I appreciated the fact that the buttons were not too small for me to control, and that the markings were easy for me to read. Of course, the most important feature of any HF radio is how good the tuning knob feels. This one has all the feel of something superbly machined. There is no wobble that I could detect, and the motion is smooth and easy. The tuning rate is front panel menu controllable at rates of 500 and 1000 Hz-per-revolution. This tuning rate may be reduced by a factor of 10 by depressing the FINE button on the front panel. Did I mention that the tuning knob has a nice feel to it?

The rear panel is also well designed. There is a minimum of clutter. The RF connectors are placed in such a manner as to minimize coax runs from their respective circuit boards. There are two selectable HF ports, as well as a handy RCA jack input for the ham who has a beverage or two that he or she would like to employ. The really nice thing is that the RCA jack is menu-selectable. There is no need to pull the cover off and manipulate a tiny microswitch.

There is a nice feature brought forward from (if I remember correctly) the TS-570. There are two separate CW interface ports. One is the standard stereo jack for the keyer paddles. The other is a direct keying jack that functions in parallel with the keyer. This is really nice when using your favorite contest logging software. You can operate the keying function of the logging software and the internal paddle simultaneously. And I might as well mention it now: There is also a menu item that allows the keyer to override the direct keying port if the operator so desires.

Circuitry overview

As I stated earlier, the TS-2000 operates by the carefully planned manipulation of a matrix of common circuitry, as well as a cadre of dedicated components. For example, the receiver front ends and transmitter power amplifiers operate as common assets for the two receivers. There are, in essence, two independent receivers. One is referred

Transmitter			TS-2000 TS-B2000	TS-2000X
Output power	SSB/ CW/ FSK/ FM	Max.	100 W (160 m ~ 2 m band)/ 50 W (70 cm band)/ 10 W (23 cm band)	
		Min.	5 W (160 m ~ 2 m band)/ 5 W (70 cm band)/ 1 W (23 cm band)	
	AM	Max.	25 W (160 m ~ 2 m band)/ 12.5 W (70 cm band)/ 2.5 W (23 cm band)	
		Min.	5 W (160 m ~ 2 m band)/ 5 W (70 cm band)/ 1 W (23 cm band)	
Modulation	SSB		Balanced	
	FM		Reactance	
	AM		Low level	
Spurious emissions	160 m ~ 10 m band		–50 dB or less	
	6 m ~ 70 cm band		–60 dB or less	
	23 cm band		–50 dB or less	
Carrier suppression (SSB)			50 dB or more	
Unwanted sideband suppression (modulation frequency 1.0 kHz)			50 dB or more	
Maximum frequency deviation (FM)	Wide		±5 kHz or less	
	Narrow		±2.5 kHz or less	
XIT shift frequency range			±20.0 kHz	
Microphone impedance			600 Ω	

Table 3. *Transmitter performance specifications. Source: Kenwood Service Manual.*

to as the MAIN receiver, and the other the SUB receiver. The MAIN receiver's frequency is displayed in the prominent central position above the main tuning knob, while the SUB receiver is displayed in a half-sized font to the right. There is an exception to this, of course, as in the case of satellite operation, where the A and B bands may be switched back and forth, and when the MAIN unit is operating in SPLIT mode. It should be noted that even when something other than the SUB receiver's frequency is being displayed in the right window, it continues to operate normally. This is to say that the SUB function is not suspended when the MAIN section is operating SPLIT.

The audio detection of the various operating modes (other than FM in the SUB receiver) is accomplished in the final IF using DSP. The ability to set the center frequency and width of the IF DSP filter on the fly means that there are no expensive crystal or mechanical

Transmitter		TS-2000 TS-B2000	TS-2000X
Frequency range	160 m band	1.8 ~ 2.0 MHz (K-type) 1.81 ~ 2.0 MHz (E-type) 1.83 ~ 1.85 MHz (E2-type)	1.8 ~ 2.0 MHz
	80 m band	3.5 ~ 4.0 MHz (K-type) 3.5 ~ 3.8 MHz (All E-types)	3.5 ~ 4.0 MHz
	40 m band	7.0 ~ 7.3 MHz (K-type) 7.0 ~ 7.1 MHz (All E-types)	7.0 ~ 7.3 MHz
	30 m band	10.1 ~ 10.15 MHz	
	20 m band	14.0 ~ 14.35 MHz	
	17 m band	18.068 ~ 18.168 MHz	
	15 m band	21.0 ~ 21.45 MHz	
	12 m band	24.89 ~ 24.99 MHz	
	10 m band	28.0 ~ 29.7 MHz	
	6 m band	50.0 ~ 54.0 MHz (K-type) 50.0 ~ 52.0 MHz (E-type) 50.0 ~ 50.2 MHz (E2-type)	50.0 ~ 54.0 MHz
	2 m band	144 ~ 148 MHz (K-type) 144 ~ 146 MHz (All E-types)	144 ~ 148 MHz
	70 cm band	430 ~ 450 MHz (K-type) 430 ~ 440 MHz (All E-types)	430 ~ 450 MHz
	23 cm band	1240 ~ 1300 MHz (w/ UT-20)	1240 ~ 1300 MHz

Table 4. *Transmitter operational specifications. Source: Kenwood Service Manual.*

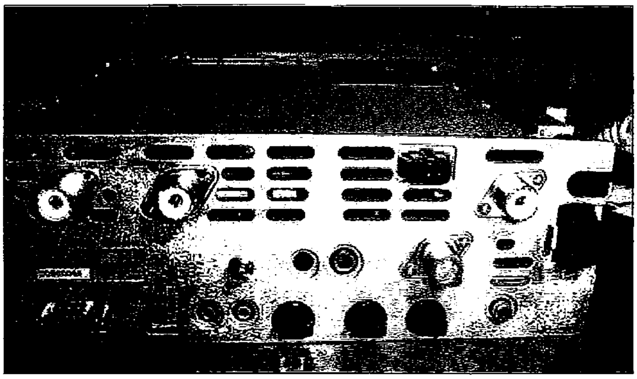


Photo B. The rear view shows the very solid nature of the chassis, and the position of the various interfaces. Note that the UHF antenna connector is type-N. The antenna connector for the 1296 module is a pigtail (not installed on this radio) that protrudes from the black cover in the upper right-hand corner. (This and remaining photos by Rick Olsen)

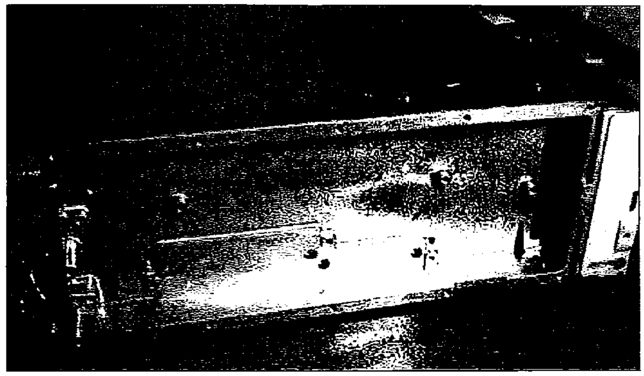


Photo C. This is the enclosure for the 1296 module. Note that there is a conductive cover over the upper portion of the chassis, which houses the transmitter power amplifiers and the antenna tuner. On the lower right you can see that the front panel is hinged to allow direct access to the control board and display components.

filters to purchase. However, since both receivers cannot use DSP detection simultaneously, the SUB receiver only operates on FM and AM. There are a number of audio DSP algorithms available to the MAIN receiver (which will be discussed in a bit). DSP is used in the transmit path as well. This allows the user to program special RX and TX audio characteristics from the main menu. The frequency response of the RX and TX may be tailored to the specific tastes of the operator, or, if you are a kind-hearted soul, to the tastes of the listener at the other end.

There are three RF power amplifiers (four with the 1296 module installed). All three amplifiers run class AB, allowing linear operation on SSB and AM. They are quite rugged as well. The 2m and HF/6m amps shown in **Fig. 1** are on the large board on the underside of the radio, and both are capable of 100 watts. The 440 amp is on its own board, and puts out 50 watts. Here is a case where the aluminum casting design comes in quite handy. It functions well as a heatsink, and is cooled by a very quiet fan that is controlled by temperature sensors.

I almost forgot to mention the superb automatic tuner that is included with the TS-2000. This is one of the better ones that I have used so far. While most of the automated tuners intended to drive coaxial antenna circuits are limited to around a 3:1 VSWR, this one is not. It has successfully tuned circuits with an indicated VSWR greater than 6:1. It has its limitations, though, and it will tell you up front. The limit appears to be in the 6:1 range, and will refuse to tune above that. It will also send you a polite "SWR" in Morse code to let you know that the tuning limit has been exceeded (a warning to you "slow-coders" out there — it's faster than 5 wpm). I was very pleasantly surprised at the speed and range of this tuner.

Back to DSP

Part of the genius of this radio is the way in which it does signal processing. In this radio there is not one, but two independent DSP chips (see **Photo J**). They both run at a clock speed of 100 MHz, and actually communicate with each other when performing their individual tasks.

I have already mentioned that the operator may select preset frequency contouring for receive and transmit

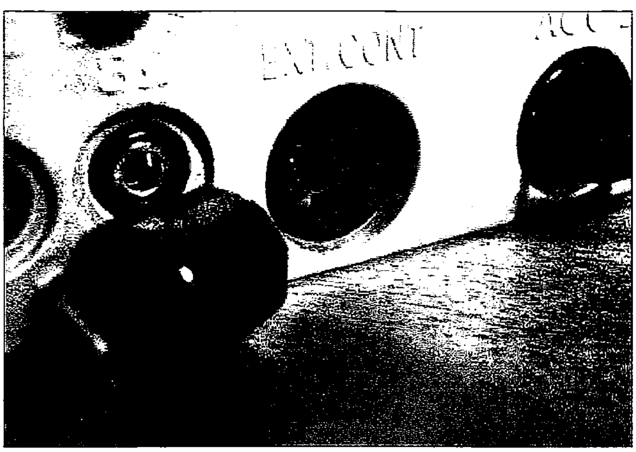


Photo D. The accessory ports have dust covers to protect them when not in use.

Photo E. The com port, which doubles as the rig control and TNC interface, is a DB-9. The "panel" port to the right is the interface for the RC-2000 remote head.

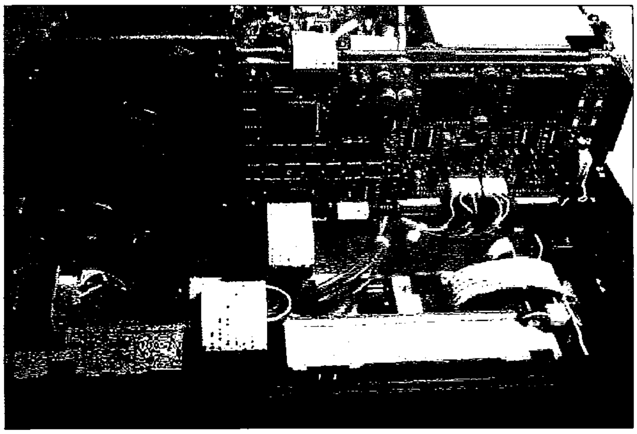


Photo F. This is the front view with the display tilted down to provide access to the display boards, and to the control board that houses the TNC and DSP components. I was quite surprised at how quiet the fan is, especially considering its size.

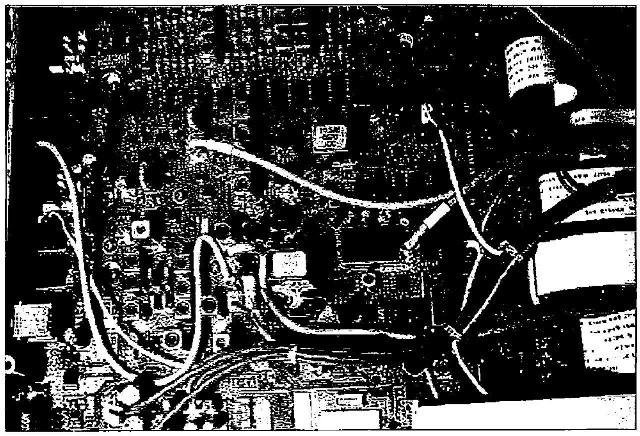


Photo H. This is the main TX/RX unit circuit board. This is where all the "sharing" occurs. Note that there are numerous coax and ribbon cable interfaces to the smaller ancillary TX/RX units not shown here.

audio from the menu. What I did not mention is that the soon-to-be-released ARCP2000 radio control software will provide the ability to personalize one of those menu items. I hope to have a separate feature on that software in the near future. (I wrote this review during and after the big earthquake here in Seattle, so I didn't get a chance to review the software.)

As for the IF filters, there are default settings that come up when a given mode is selected for the first time. You may then select the center and width of the filter for that mode according to your own tastes, and the radio will remember that setting from then on. You don't need to re-enter these settings every time you turn the radio on. For your convenience, the center frequency and filter width are set using two vernier knobs in the lower left-hand corner of the front panel. The front panel shows both analog and alphanumeric displays of the filter settings.

Photo G. The circuit boards consist of primarily surface-mount components, with a smattering of larger discrete devices.

Another aspect of the power of this formidable DSP engine is the ability to reduce broadband noise and coherent interference. The MAIN receiver enjoys two types of noise reduction filters. The first, called NR1, is a linear adaptive filter that is similar to that found in many modern transceivers. What is noteworthy is that the threshold of NR1 mode is front panel selectable, or may be left in the AUTO mode. I have played with this a bunch, and found that leaving it in the AUTO mode works fine for me, especially when working SSB and FM. I should mention that the SUB receiver can employ this filter as well, but only this one. The others are not available

The second mode is NR2, which is a correlation algorithm that has a variable duration of 2 to 20 msec. This is an excellent filter for CW use, but takes a little time to get used to. I have found that a setting of 8 msec is ideal for the type of CW operating that I enjoy, which ranges in speeds from about 18 to 30 wpm. It also took me a little time to get used to the mechanical artifact sound of the background noise. It sounds more like a babbling brook than the soft hiss of a Collins 73S3. Not to worry, though. It will sound normal to you in no time.

The TS-2000 has three, count them, THREE digital mechanisms for getting rid of those pesky 40m AM carriers and careless tuner-uppers. The first is an automatic notch filter with a variable threshold that can be controlled from the front panel. This is useful if there is some distortion or other modulation characteristics present on the unwanted carrier. There is also a beat-canceler, which leaves the IF passband alone, and removes the note from the audio. It is an adaptive filter that can handle more than one beat note, and will automatically shift frequency in synch with those tones that drift about.

If you're like me and have been frustrated by the efficiency of these types of unwanted tone removers, especially when they work so well at also canceling the station you want to listen to on CW, then fret no more. The TS-2000 also has a MANUAL beat canceler. This is great! I finally have the ability to notch out that nudnik who likes to tune up on me when I am in QSO on CW. What a blessing, and it works very well. And what's better is that it doesn't introduce a lot of distortion to the passband like the analog notch filters do.

There are some additional features associated with the DSP engine in this

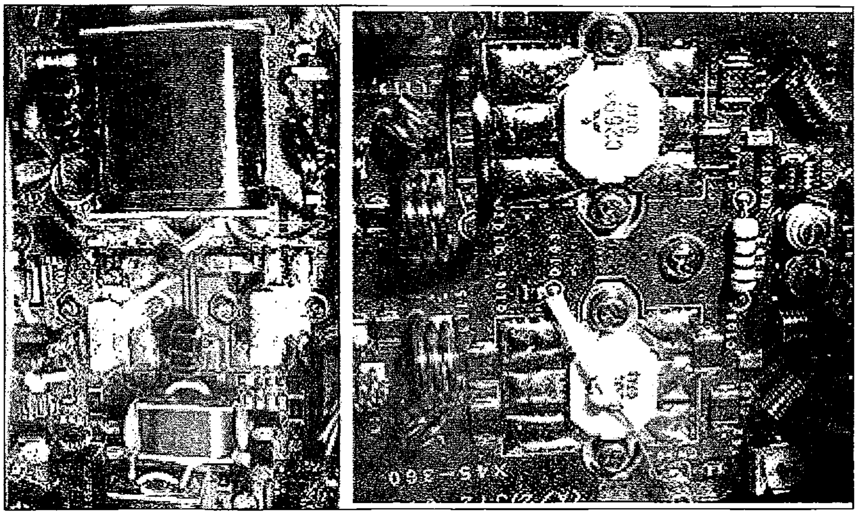
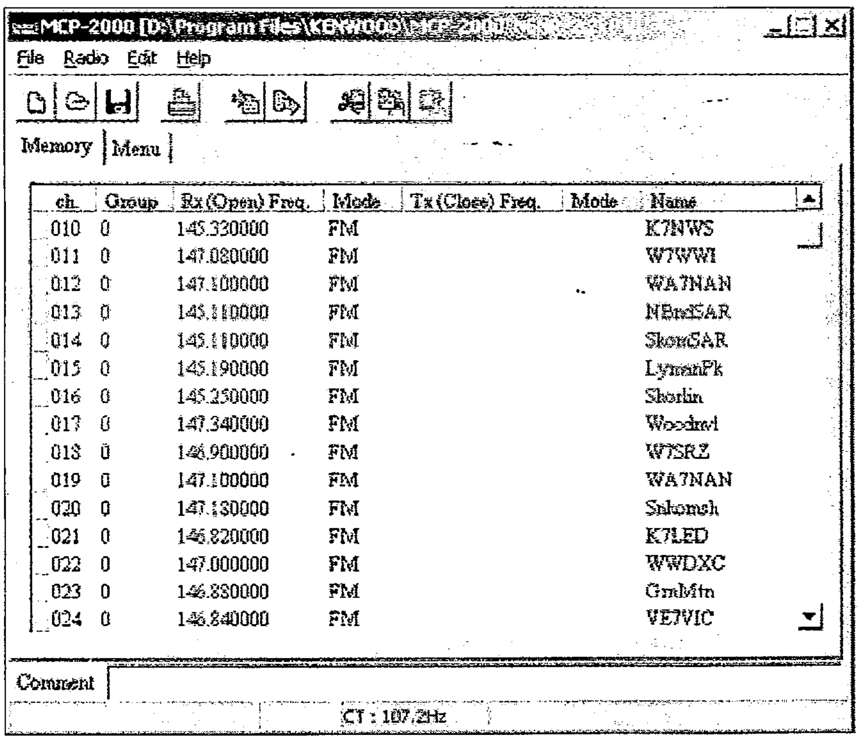


Photo I. The RF power amplifiers are very rugged, and represent the latest in device technology. The 100W HF amp is on the left. The 100W VHF amplifier is on the right. The 50W UHF amplifier is on a separate board not shown here. I might add that the HF amp stands as a testament to the design of my late friend Helge Granberg, K7ES/OH2ZE. The design that he pioneered in the early '70s is still with us today. The good stuff always stands the test of time.

radio, like the vernier control of the AGC, that you can discover on your own.

Additional features

This radio is so feature-rich that if I were to describe all of them, this article would cease to be an operator's review, and become a rewrite of the operator's manual. But there are a few that should be mentioned, the first of which is the memory and configuration management capability of the TS-2000. There are 300 memory channels available,



ch.	Group	Rx (Open) Freq.	Mode	Tx (Close) Freq.	Mode	Name
010	0	145.330000	FM			K7NWS
011	0	147.020000	FM			W7WWI
012	0	147.100000	FM			WA7NAN
013	0	145.110000	FM			NBndSAR
014	0	145.110000	FM			SkomSAR
015	0	145.190000	FM			LymanPk
016	0	145.250000	FM			Skorlin
017	0	147.340000	FM			Woodnvl
018	0	146.900000	FM			W7SRZ
019	0	147.100000	FM			WA7NAN
020	0	147.130000	FM			Snkomsh
021	0	146.820000	FM			K7LED
022	0	147.000000	FM			WWDXC
023	0	146.880000	FM			GmMtn
024	0	146.840000	FM			VE7VIC

Fig. 1. This is the memory control panel for the MCP2000 software provided for free by Kenwood.

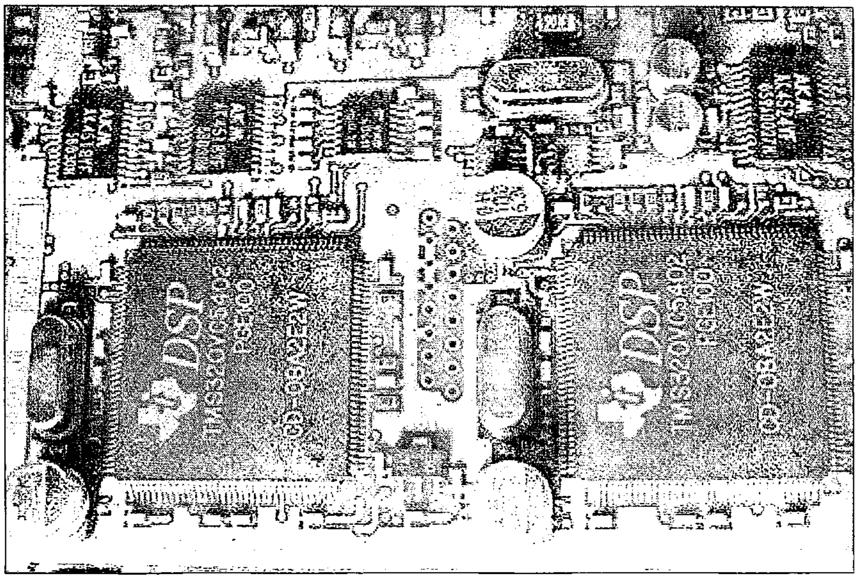


Photo J. Not one, but two TMS320s serve as the core of the DSP functions inherent within the TS-2000. One processes the IF and functions as a variable bandpass filter and demodulator, while the other does the audio processing (noise reduction, etc.). This DSP engine also allows for linear control of the AGC time constant.

which are easily programmable from the front panel. Let me tell you that this is a real blessing. These channels may also be programmed with an alphanumeric name tag (also from the front panel) that facilitates easy recall of just why-in-the-heck I saved each frequency and mode. These memory channels may also be grouped and scanned in 10 subgroups. This is quite handy for segregating the frequent- from little-used channels in the scanning process.

If you are in a hurry, and don't want to fiddle with programming a specific

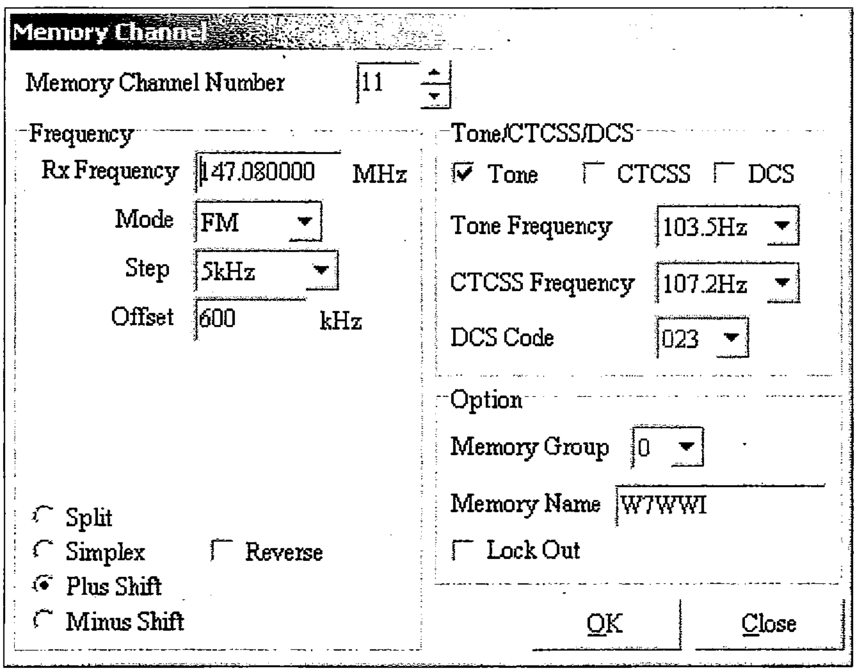


Fig. 2. This shows the detailed control panel that may be used to program each memory channel. This detail may be copied from channel to channel using the main memory control panel, and then modified here. This prevents the need to re-program every detail when perhaps only the memory name and frequency are different.

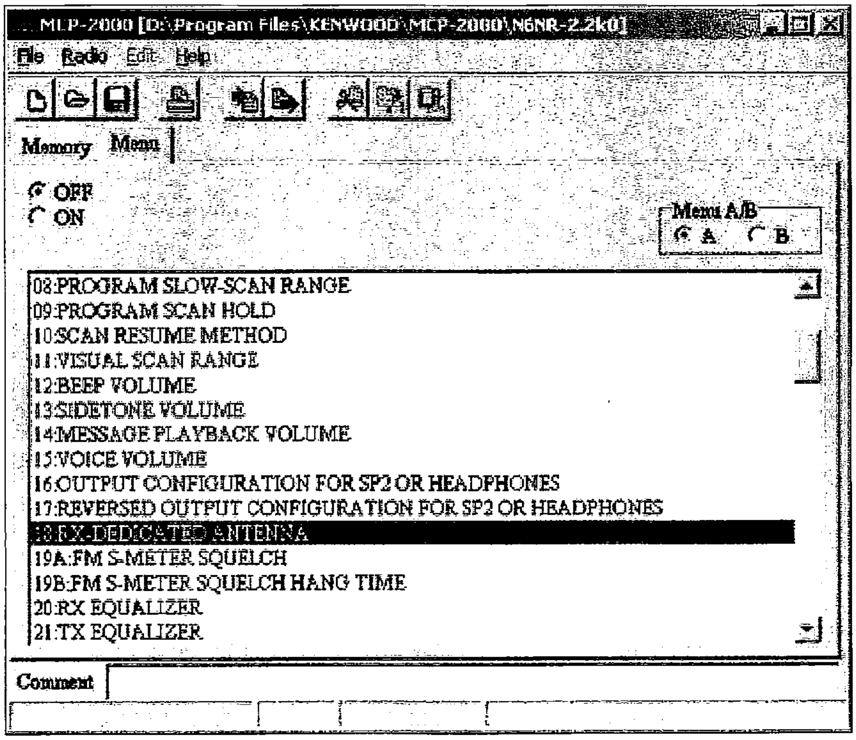


Fig. 3. This is the menu for the memory control. Each menu item is programmable from this panel. Note that it also allows for the programming of the settings for each of the two primary menu configurations that can be set for a specific operating mode or location.

channel, there is also the QUICK MEMORY function that may be used in the VFO mode, and provides convenient storage of 10 channels for quick retrieval. It has been very handy for me in contests, and in pileup management. It stores things like frequency, RIT settings, operating mode (CW, USB, etc.), and interference rejection modes.

There are also two generic memories for storing the basic configuration of the radio. If you operate the radio as both a mobile and base station, the entire configuration of the radio (all of the menu-controllable items) may be stored for those two operating environments. Another use would be simply to differentiate between primarily CW or SSB operation, or between contesting and rag-chewing. You get to choose, and it's all commanded by a couple of front panel keystrokes.

One of the things that I feel is commendable concerning Kenwood is that fact that they DON'T charge their customers for memory control software, and make it available in downloadable form on the Internet. If you go to the [http://www.kenwood.net] web page, you can download a program called MCP2000 that allows for simple programming, storage, and retrieval of these formidable memory functions. **Figs. 1, 2,** and **3** are screen captures of MCP2000. **Fig. 2** shows an expanded control panel that allows detailed programming of each memory channel shown in **Fig. 1**. **Fig. 3** shows how each menu memory setting may be programmed without having to go to a separate panel for providing the programming detail. This software is a must. I highly recommend it, and it's FREE.

Packet terminal node controller

One area where Kenwood has been out front in the development of technology for us radio amateurs is in the inclusion of packet terminal node controllers (TNCs) in their transceivers. They started with a handheld (TH-D7G), and quickly included their flagship dual-band mobile (TM-D700A). They have closed the product line loop with the TS-2000. The TS-2000 service manual states that the TNC is the same one developed for the TH-D7 by Tasco. It appears to me, at least, that this is the same product that has gone into the TH-D7 and TM-D700, and the Alinco DR135TP. Only minor variations in the command set for the TNC in each radio exist. Kenwood's statement about the derivation of the TS-2000's TNC appears to be right on the mark. Although there is no obvious way to connect a GPS receiver to the TS-2000, the GPS commands found in the TH-D7 instruction set can be observed when sending the DISP command to the TNC in the TS-2000. I am

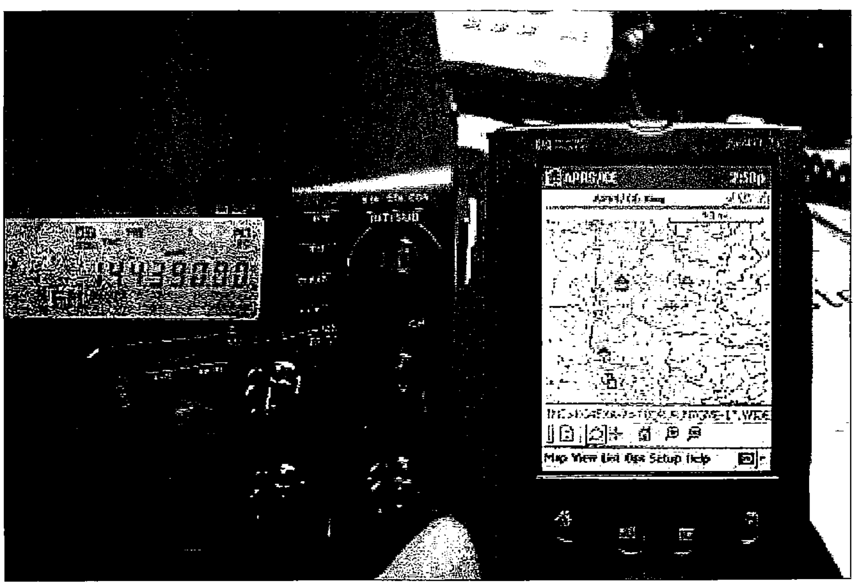


***Photo K.** This is a snapshot of Rob Wittner's APRS/CE program running on my Jornada 548 in conjunction with the PACKET mode on the SUB portion of my TS-2000.*

hoping that a future "blue-wire" mod will come forth from either Kenwood or the general amateur community that will allow GPS interface via one of the unused ACC ports (hint, hint).

The TNC itself is a modest performer, and has been well chronicled in other reviews that feature the radios mentioned above that also have it on board. Interface between the TNC and a PC or laptop is accomplished via a DB-9 serial port on the back of the radio. No high-priced level converters are required. In the case of the TS-2000, the TNC's function is enhanced by its ability to access the DSP chipset to provide some prefiltering when operating AFSK at 1200 bps. At 9600 bps, the TNC has a direct analog route to the outside world via the FM modulator and discriminator. KISS mode for TCP/IP is included, and I can vouch for the fact that it seems to work quite well at both baud rates. I had an opportunity to test it on the local TCP/IP network that is run by Puget Sound's WetNet Experimenters Group.

Although the APRS functionality found in the TM-D700 is not included in the TS-2000, there is yet one very unique and useful internal function that it can perform. It is called the Packet Cluster Tune (PCT) function. This is really slick, and it works like this. The user sets the SUB RX to the local DX packet cluster frequency, sets the SUB RX as the data band, and turns on the PCT function. When a packet cluster DX spot announcement is received, the frequency, callsign and other related data appear in the SUB window. The information is also automatically written to the QUICK MEMO pad for later retrieval.

The PCT function may be configured by front panel menu commands to do the following. First, it will provide an announcement to the operator in the form of a beep, a CW recital of the callsign, or (if you have the optional VS-3 voice synthesizer unit installed) a voice announcement of the same. That's not all. You can also set this function to automatically set the radio to the frequency from the DX spot that is displayed in the SUB window. If that sounds like a potential inconvenience, the radio may also be configured to only change frequency when commanded to do so by depressing the SET button. I showed that function to some of the members of the Redmond Top Key Contest Club, and they got a big kick out of it. I have to admit that I have used that function quite a few times myself. It really helps to keep the traffic density down on the packet cluster channels, as this is a passive feature (meaning it doesn't require any transmitting). With the dual radio personality of the TS-2000, the monitoring of the packet cluster channel is uninterrupted while carrying on a QSO on HF.

Wrap-up

There is much more that I could write about the features and performance of this radio. I intend to write a separate review on the anticipated ARCP2000 remote control software that is soon to be released with their introduction of the "box" version of the radio. You heard me right. By the time you read this, Kenwood will have released the TS-B2000, which is a blank-faced version of the TS-2000 that may be controlled by the ARCP2000 software on a PC or laptop, and via the RC-2000 remote control head (borrowed from the TM-D700). In that review, I will also talk a bit about the following features:

- Sky Command II
- Crossband repeat
- Remote control
- Microphone control
- Direct FSK operation
- Satellite operation
- User-defined digital filtering of RX and TX audio

Until then, I encourage you to have a close look at this fine radio for yourself. My neighbor did, and went in and bought one for himself, and he is very critical of radios — their performance and features, that is. That in and of itself is a testimony to the impact that this rig can have on hams who come in contact with it.

The bottom line is that Kenwood has not just produced an excellent radio. What they have done is to further the state-of-the-art in affordable amateur equipment. And I will stand by my assertion that this radio provides a very high level of features and performance for its price, which, by the way, is currently about $2,270 over the counter. When I first heard about its impending introduction, I was certain that the price would easily exceed three kilobucks. Having said that, I believe that the price including the optional accessories such as the VS-3 voice synthesizer, the DRU-3A digital recording unit, the RC-2000 remote kit, and the soon-to-be-released UT-20 1296 module, will drive the total cost over that mark. However, these are optional items that can be purchased later based on a value-added decision that concerns your own operating needs and desires. The radio as it stands today is quite impressive.

Congratulations and many thanks to Kenwood for maintaining their vision, engineering and manufacturing skills, as well as the financial commitment required to continue to provide innovative products to the amateur radio marketplace. 73

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Bookbind THIS! — Conclusion

Get organized, and save money, too.

This is the third and final part of this series. The previous two described the tools, materials, and fixtures required for the processes involved. The objective behind the process is to save valuable technical information that has been placed into your hands. Most all of the technical knowledge shared with us is in the form of a schematic diagram, which, if saved, will continue to share the knowledge forever.

The final stage of the process involves rasping the stem of the "new" volume in preparation for the stem to be glued. After being glued, the new volume is then ready for a cover that will be marked to identify the new volume. The end result will be the recovery of shelf space while saving valuable information in an organized manner.

Prep stage

After clamping the stack tightly, the paper stem will be cut using a rasp, and if tight enough the paper will cut like soft wood (see **Photo A**). For binding purposes, it is desirable to create a straight/square-cut stem. The rasp is best held with both hands and drawn at a 45-degree angle downward across the stem. Rasping continues until about 1/8-inch of the stem remains exposed beyond the blocks — or until the shortest page is exposed. Upon inspection, if it appears that the lower pages have folded away from the rasp rather than be cut, the rasp cutting direction can be reversed such that the rasp is drawn upward while you take note to make sure the lower pages are being trimmed to match the others.

One of the objectives of rasping the stem is to reduce the wider pages to be equal to the narrowest ones. But there is no guarantee that all of the pages will be exposed to the stem backing after the rasping appears to be complete. In an attempt to pick up all of the pages and to mechanically strengthen the stem region of the "new" volume, kite string is tied into the stem. Three

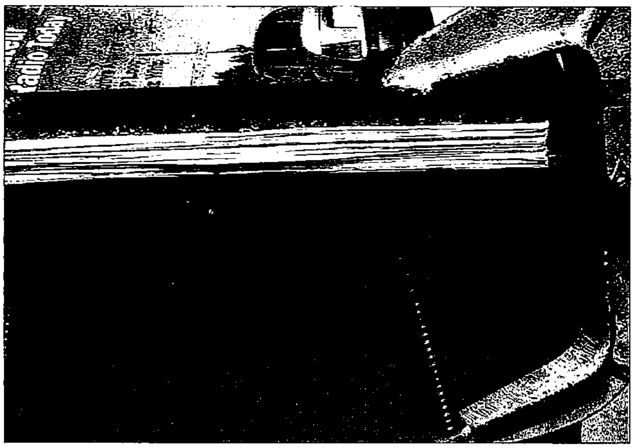

Photo A. *Annual volume stacked in the clamping fixture. Note the ragged stem prior to being trimmed with the rasp.*

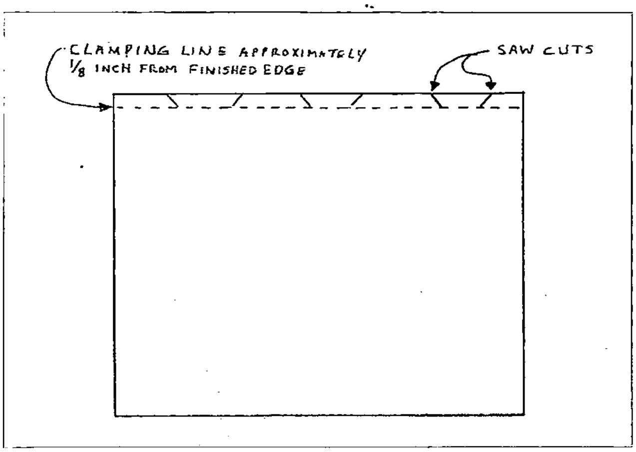

Fig. 1. *Saw cuts for kite string. Cuts made at approximately 30–40 degrees.*

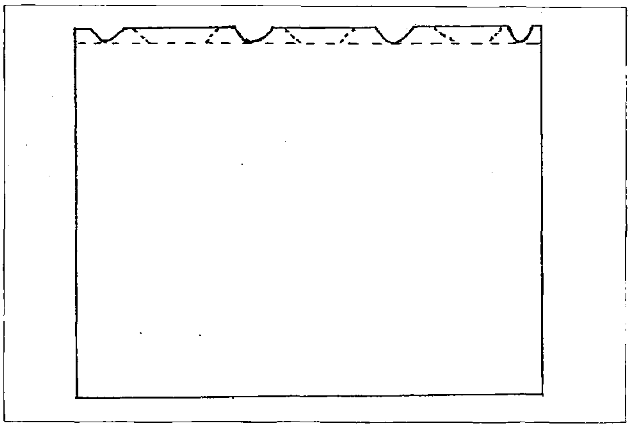

Fig. 2. Deep file cuts/notches used to expose the narrowest pages for gluing.

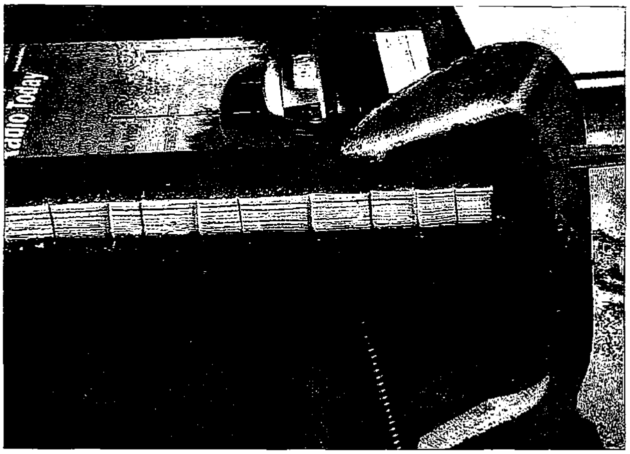

***Photo B.** Stem after being rasped, sawed, and notched.*

pairs of saw cuts are made into the stem area as shown in **Fig. 1**. The specific angle of the cut is not at all critical, but it must be at a slight angle sufficient to keep the string in place until glue is applied.

A loose page found in a newly bound volume is very frustrating, so an additional precautionary step is taken in the process. The precaution step taken is shown in **Fig. 2**, where the sharp teeth on the edge of the rasp, and/or the rounded side of the rasp, are used to cut some deep "V" or "U" shape cuts in the stem. The cuts are as deep as the clamping fixture will allow (about 1/8-inch), and are made sufficiently wide to allow glue to reach deeply into the stem area and hopefully capture ALL of the pages (see **Photo B**).

Once all of the rasping and cutting has been completed, the stem should be vacuumed well to remove as much paper dust as possible. I've found that a shop-vac with a narrow pickup nozzle works best.

When everything is clear of dust, kite string is placed into the saw cuts (see **Photo C**). I've found that looping the string twice around and through the cuts is sufficient. The string is looped through each pair of angular cuts and pulled fairly snug. In most cases, three sets of string cuts are ample to maintain the strength of the stem for normal usage.

The ends of the string are tied only tight enough to keep the string from falling out of the saw cuts. Once applied, the glue will hold the string in place. The ends of the string beyond the knot may be left fairly long to be glued against the back of the stem, providing extra strength.

The last step before removing the volume from the clamps is to apply glue to the stem area (see **Photo D**). I've found that an acid brush works well because it has a stiff hair bristle. Glue is worked into the saw cuts in an attempt to coat the string that is buried in the cut. Glue is then spread along the stem and into the "V" or "U" cuts and scrubbed into the paper. How much glue should be applied? The amount isn't too critical at this stage, but it should touch each page and not be so heavy that it runs off onto the fixture. The book volume is a little difficult to remove from the clamping block if the glue has gotten between the paper and the block. A sharp knife or razor blade may be used to cut the glue, should it be necessary. Just lift

Continued on page 34

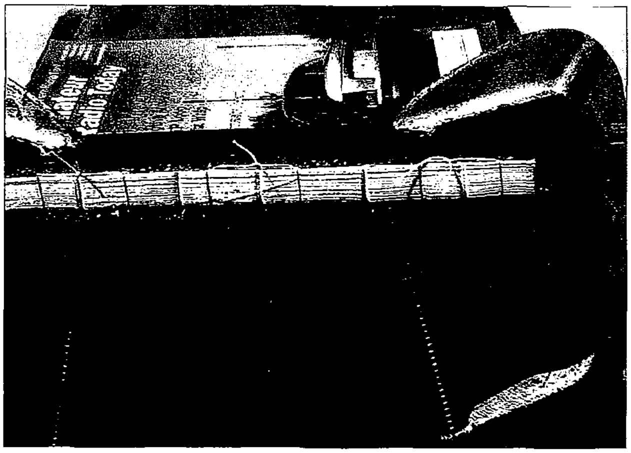

***Photo C.** Kite string tied through sawed slots. Loose string ends left to be glued against the stem.*

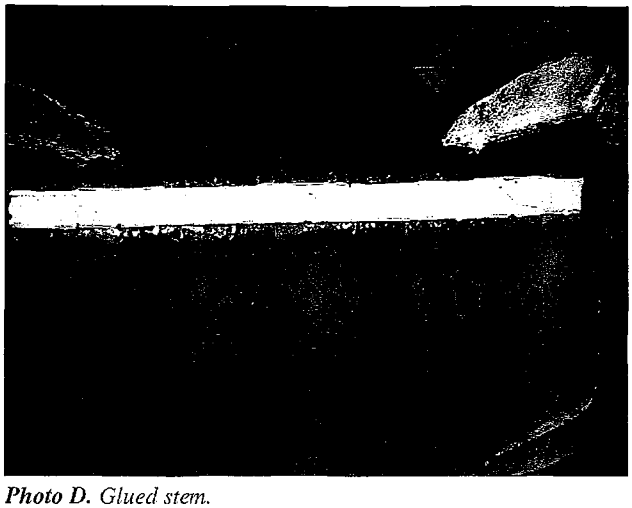

***Photo D.** Glued stem.*

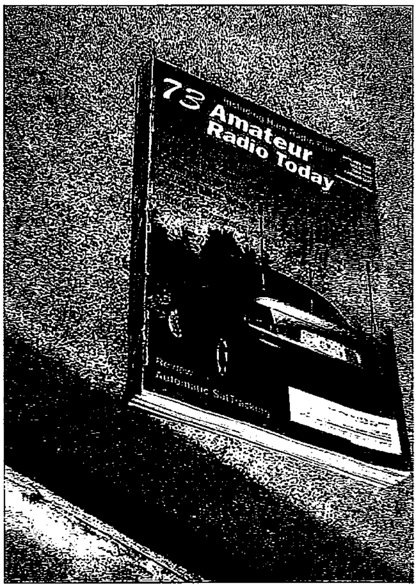

Photo E. Completed/glued stem. Volume is ready for the cover.

Bookbind THIS! — Conclusion

continued from page 33

the book, exposing the glue strip, and cut it with a blade.

More glue will be added later on so that only enough need be applied at this stage to maintain the integrity of the stack/volume. **Photo E** shows the bound and glued volume now ready for a cover.

Preparing the cover

A manila folder is the easiest material to use as a cover. Most manila folders have been pre-creased several times adjacent to the fold so that they can be sized to fit the needs of the user. Unfortunately, for bookbinding applications, the creases are in the wrong position. For cosmetic reasons, the multiple-creased side is used as the back of the new cover. The exception is when accommodating a thick volume — some of the creases will end up appearing along the stem area.

During the cover preparation stage, the cover must be placed on a flat hard surface such as a tabletop. The selected front side of the cover faces upward and is then lifted to stand vertical with respect to the back. Now in an open position, the new volume is placed on the cover back while you press the stem against the vertical cover. Using a pencil, a short line is drawn on the inside of the front cover at the height of the volume (see **Photo F**). The volume is then removed and placed aside momentarily.

With the cover opened up flat, use a thumbnail or other tool to create a short crease along the pencil line at the edge of the cover. The short crease will be used to start a new fold in the cover to accommodate the height of the volume. Place a thumbnail at the edge of the cover, on the short crease, and begin folding the cover down against the thumb and table (see **Photo G**). When a distinct crease has been started, the top and bottom cover edges are aligned to one another and held tightly with hand pressure.

At this point, a new crease/fold can be started at the folder's edge by holding pressure against the two cover sides so that they won't slip or twist. A thumb is then run along from the start of the fold from the bottom to the top (see **Photo H**). If the front and rear covers remained in place during the folding, a nice straight crease should have been created.

Open up the cover, slip the "new" volume into it, and check for fit. The cover should fit well along the stem and will overhang the pages. After gluing, the cover will be trimmed to fit the volume.

Gluing the cover

Before gluing the cover, arrangements must be made for clamping the cover to the volume. Several techniques may be utilized for this purpose. I've found that standing the volume on its stem works well. Small "C"-clamps are used to hold the ends of the cover to the volume. Heavy weights are also pressed against the sides of the volume (see **Photo I**) both to hold the cover tightly against the volume and to support the volume in a vertical position while the glue dries.

Several volumes may be clamped simultaneously if the clamps are large enough, or enough weights are available.

Padding compound dries rather quickly, but it should be allowed to cure for five or more hours before the volume is opened. White glue dries more slowly and should be allowed to set for 24 hours or more.

An ample amount of glue is applied to the stem of the new volume with

Photo F. Pencil is used to mark the volume height inside of the cover.

Photo G. Creasing the cover over the thumbnail at the pencil mark.

Photo H. Cover folded over at the crease — crease being extended across the cover.

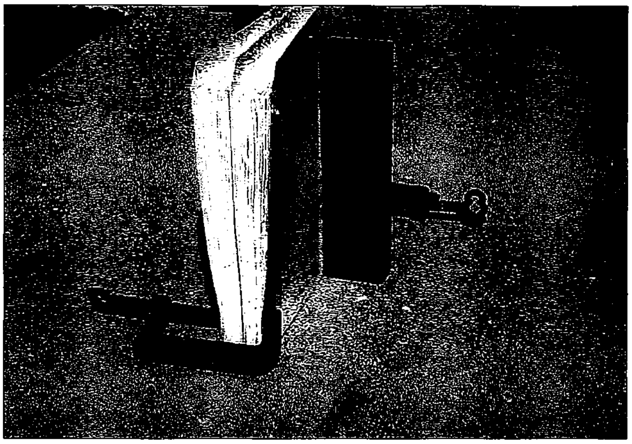

Photo I. Freshly glued volumes standing on their stem while the glue dries. Clamps/weights are used to hold the volumes in a vertical position.

care to fill all of the spots possibly missed during the binding process. A thin line of glue, about 1/8-inch wide, is run down both the front and rear edges of the volume adjacent to the stem. Glue in this area will tie down the string loops and provide additional support for the new cover near the stem.

Immediately after the glue is applied, the volume is carefully fitted into the new cover. It is important to NOT get any glue onto the cover in areas where it shouldn't be. If glue does get on areas where it doesn't belong, a water-dampened cloth can be used to remove the extraneous glue. Slipping a small piece of waxed paper between the cover and volume will prevent the residual glue spot from binding them together.

With the glued volume and cover in place, the volume should be "seated" to the cover by holding it between the hands and then allowing it to drop an inch or two onto the stem. The volume must be supported during the drop to prevent it from falling over during the impact. Once seated, the volume can be placed between weights to hold it in a vertical position. **Photo J** shows how the excess cover material is removed. Scissors are held against the volume using the volume as a cutting guide.

Marking the cover

Marking on the cover is done with a fine-tip Sharpie™ pen or equivalent. Marking is done on the cover, stem, and bottom of the volume (see **Photo K**).

On the cover, the first row of title characters should be at a position approximately three fifths of the way up from the bottom of the volume, placing it at a desirable viewing perspective. A second row, if used, is placed below the first to suit the user's perspective.

The volume year is centered and placed about an inch or so below the title characters. When there are missing issues to the volume, I've found that adding a note below the date indicating either those issues contained or those missing helps later on during a reference search.

Marking the stem and bottom should also be done as well. Title marking should begin near the top of the stem and extend down as far as necessary. The volume date is placed a short distance up from the bottom of the stem.

To facilitate identifying the volume when it is in a stack of other volumes, marking the bottom edge is very desirable. An abbreviated title and date is usually all that's required.

Opening the new volume

Care must be taken when opening

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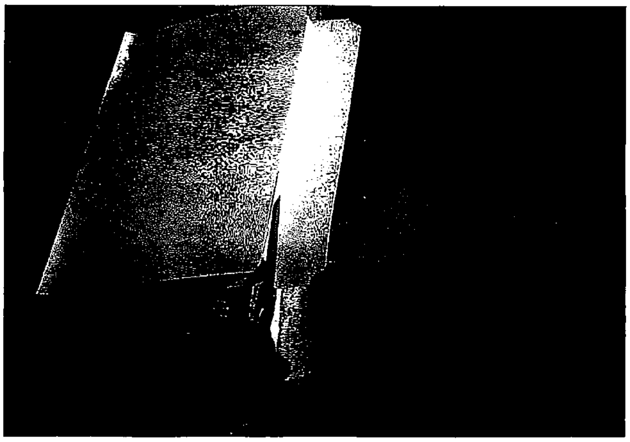

Photo J. Glued cover being trimmed flush with the volume edge.

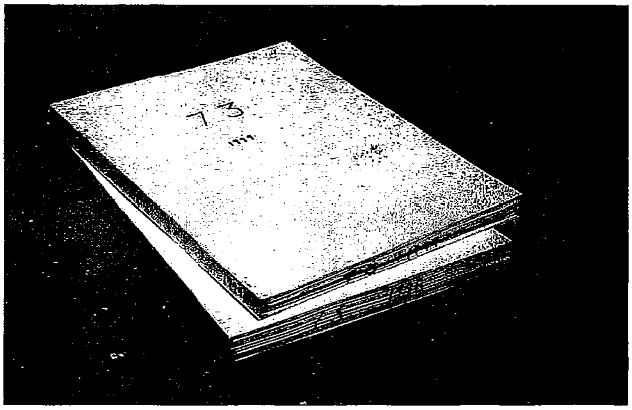

Photo K. Marking/identification placed on the cover, stem, and bottom of the volume.

Radio Direction Finding

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Find Foxes and Fight RFI with RDF

Will it be the best-attended transmitter hunt ever held in the Americas? The 2001 USA ARDF Championships are capturing the attention of on-foot foxhunters (also called foxtailers, radio-orienteers, and ARDFers) across the country and around the world.

These historic championships will take place July 31 through August 4 in Albuquerque, NM. They are open to all ARDF enthusiasts, including visitors from any member country of the International Amateur Radio Union (IARU).

As I write, E-mail has just arrived from Han ZhaoFang BG1HZF, leader of the Chinese Radiosports Association, announcing CRSA's intent to send a team to our championships. So if you didn't have the opportunity to join Team USA in its competition against the Chinese and other countries in Nanjing last fall, you have a second chance this summer, much closer to home. Australians have registered, and registrations from European countries are expected shortly.

Members of the Albuquerque Amateur Radio Club are working hard to put on a first-class ARDF event. Headquarters will be on the campus of the University of New Mexico. That's where dorm rooms and cafeterias will house and feed the participants, and training sessions will take place. The formal competitions, one each on two meters and eighty meters, will be at nearby well-mapped sites in the beautiful Sandia Mountains.

The USA ARDF Championships are for anyone, with or without a ham license, at any ARDF skill level, beginner to expert. Competitors will be divided into appropriate age and gender divisions. To learn more, visit the special Web site [http://groups.yahoo.com/group/abqardf/files/web/index.html] or contact Albuquerque Amateur

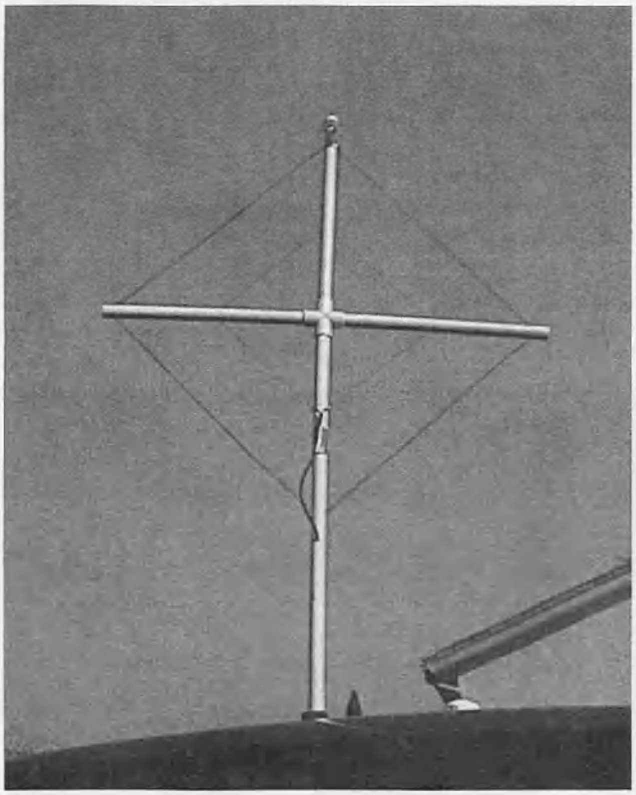

Photo A. *Not fancy, but functional, this simple loop on a PVC pipe frame will ferret out interference sources on 75/80 meters.*

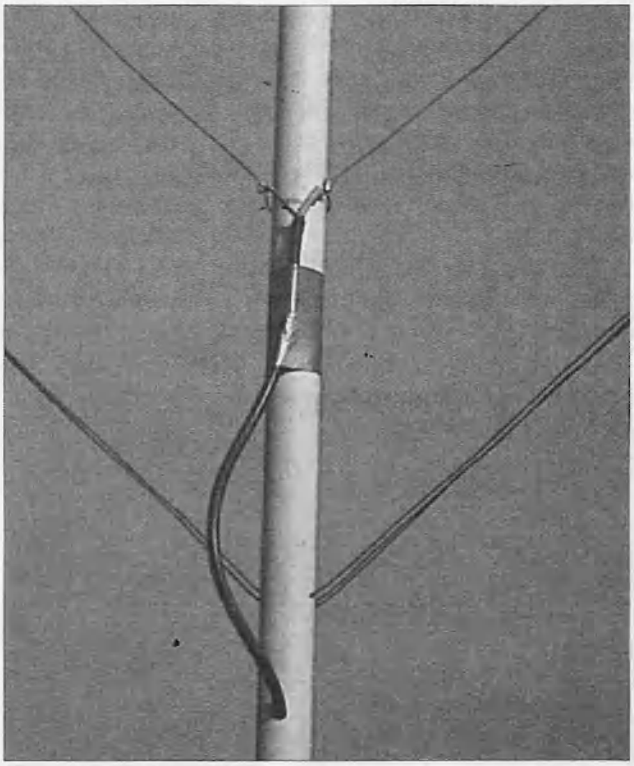

Photo B. *Coax is dressed away from main loop L1 and connects only to inner loop L2. Note the individual frame holes for each wire of the main loop.*

Radio Club, P.O. Box 11853, Albuquerque NM 87192.

Tracking RFI on 80 meters

Every ham should understand basic Radio Direction Finding (RDF) equipment and techniques. Even if you don't enjoy competitive mobile transmitter hunting or radio-orienteering, you will probably need to go DFing at some point. It's very likely that your target will be some sort of non-ham RF interference (RFI).

Over the years, I have searched for dozens of noise sources, from aquarium heaters to gas oven thermostats. One of my most interesting (and frustrating) RFI adventures took place in Stanton, California. By reading about it, you will get a good idea of how RFI detective work is done. You'll also learn some of the technical and nontechnical roadblocks you may face in your own RFI sleuthing.

The story is true, but I'll leave out actual names, calls, and addresses. The victim (we'll call him W6XYZ) loved rag-chewing and daily nets on 75 meters. One day, a strange signal began to crowd him out. It was a very unstable carrier, moving up and down the band and occasionally disappearing.

Most of the time, the signal was 20 dB over S9 and right on top of his favorite net frequency near 3900 kHz. By the time I got involved, W6XYZ's block had been checked out by the power and cable TV companies, who could not find the source in their lines.

The first rule of RFI-busting is to search on the highest practical frequency. At 80 and 40 meters, long power lines and other objects re-radiate signals and distort RDF measurements. Null-type RDF antennas are the norm. At VHF, gain antennas are practical and long radiators are less common.

I set up a general coverage receiver and a calibrated RF attenuator in W6XYZ's shack and tuned from 150 kHz up, making a chart of all RFI carriers by frequency and relative amplitude. There were a lot of them, but they all sounded different. The strongest (20 dB above the 3900 kHz spur) was at 3400 kHz.

Harmonics at varying levels (11 to 33 dB down) were present every 3400 kHz all the way up to 30 MHz, the top of the receiver range. I figured that the 15th harmonic at 51.05 MHz should be strong enough to detect. If so, my six meter T-hunt "Shrunken Quad" (see "Homing In" for January 1990) could DF the source.

A few days later, April WA6OPS and I were back with the van set up for six meter hunting. The 51 MHz harmonic dropped off rapidly as we drove away from W6XYZ's home. All the bearings pointed right back to his house. Using a Yaesu FT-690R and its whip, we sniffed around the house and found the source of the 51 MHz harmonic. It was the solar heating control unit in W6XYZ's own closet!

Gleefully, we turned off the controller and ran to the shack to check the HF bands. Sure enough, the noise at 3400 and its harmonics had stopped. In fact, the spectrum was very quiet — all except the signal at 3900 kHz. It was as strong as ever. Rats!

Building a loop

So the direction finding had to be done on 75 meters. There was no time or motivation to do anything fancy. All we needed was an indication of which way to go. A loop antenna was the clear choice. It only took a couple of hours to build. All the parts were in my garage.

The main loop (L1) is three turns of 18 AWG solid enameled wire, resonated with a 100 picofarad air variable capacitor (C1). Signal snagged by this outer loop couples to the coax via single-turn inner loop L2. Inductive coupling works much better than direct coax connection to L1, which would upset balance and cause poor nulls.

Photo A shows the completed antenna on the T-hunt van. The frame is Class 125 (thin wall) PVC pipe, 3/4-inch trade size. That matches with my standard mast system for hunting on other bands. Note that the coax bows slightly so it does not touch the bottom of L1 (**Photo B**).

To build this antenna, cut the top and side PVC frame members and assemble them into a slip-type PVC cross fitting. Bond them with PVC pipe glue. Use a 5/64-inch drill bit to make individual holes through the mast and crosspieces for the three large loop wires. Space the turns of the large loop about 3/16 of an inch apart. Holes for the large loop wires are 16 inches from the center of the cross, and holes for the inner pickup loop are 8 inches out.

Tuning the antenna is easy — just connect it to the receiver and peak the background noise on the hunt frequency by adjusting C1 with an insulated tool (**Photo C**). Keep yourself and other objects clear of the loop during tuning.

Check out your loop on a local (groundwave) signal before going RFI-hunting. The pattern of small (less than 0.08 wavelength) loops like this has two broad peaks (in the

Continued on page 38

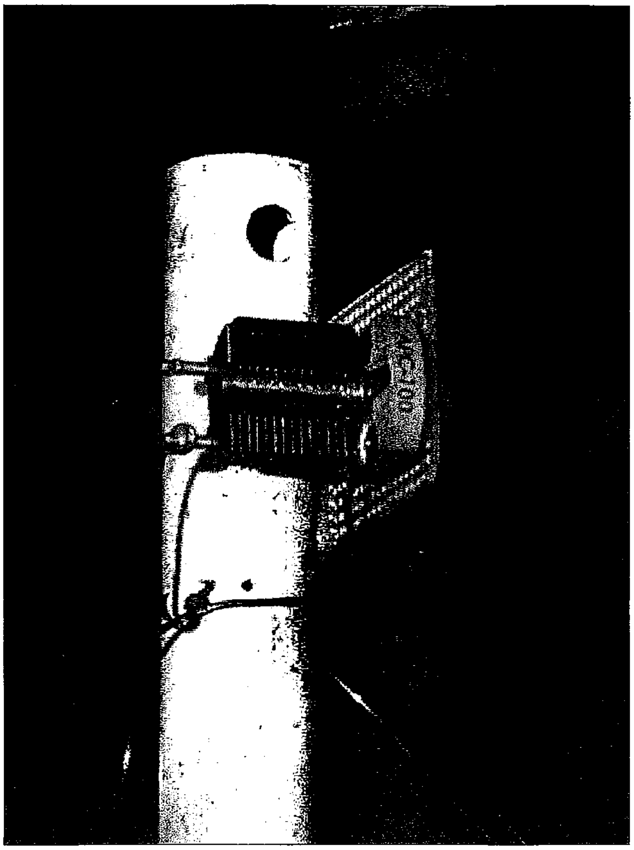

Photo C. Air variable capacitor C1 is mounted on a small bracket at the top. It is in series with the main loop, L1.

Homing In

continued from page 37

plane of the loop) and two sharp nulls (looking through the loop). The nulls are easiest to use and most accurate for RDF.

The ambiguous nulls 180 degrees apart would cause problems in a long distance T-hunt, but not in a neighborhood RFI search. Just take several "fixes" from well-spaced locations around the area and plot the lines of bearing on a map. They should intersect near the interference source. Follow the bearing lines and home in. I made enlarged copies of street maps in W6XYZ's area to mark up with bearings.

If necessary, you can resolve the 180-degree ambiguity by using the directivity of a mobile whip on your vehicle. Typical 75-meter whip systems show higher S-meter readings in the direction of greatest amount of ground plane. For example, if your whip is on the left rear bumper, it will give a slight amount of enhancement to signals coming from the right front.

Be sure to remove your 75-meter whip from the car while DFing with the loop. The proximity of a resonant whip causes inaccurate loop nulls. Similarly, avoid taking bearings when directly under power lines, etc.

If you expect to hunt very strong signals and your receiver does not have a wide range RF gain control, connect an RF attenuator between antenna and receiver. Do not transmit into the loop or attenuator. Unplug the mike and key to prevent accidents.

The loop will not give good nulls close-in if a long power line or the wiring of a house radiates the RFI. For example, let's say you are 200 feet away from the center of a radiating overhead power line 400 feet long. The difference in azimuth from the left end to the right end of the line is 90 degrees.

When you attempt to null the left end, the right end lies in the peak of the loop response. No matter which way you turn the loop in this case, there will be some signal to "fill" the null in the pattern. So when you get too close to get good nulls, switch from the loop to a whip and move around, looking for highest S-meter readings.

Sources for C1

Surplus Sales of Nebraska
1502 Jones St.
Omaha NE 68102
(402) 346-4750
[www.surplussales.com]
Part number: (CTA)APC-100

Ocean State Electronics
P.O. Box 1458
Westerly RI 02891
(401) 596-3080
[www.oselectronics.com]
Part number: APC-100

Closing in

A few days later, we went off to Stanton to snoop around with the loop. RDF bearings and S-meter readings showed the hottest area to be about two blocks away from W6XYZ in a cul-de-sac. The curbside signal was strongest in front of House A, and almost as strong in front of House B. Both were fed from one overhead power line in the rear.

House A's owner was not at home, so we rang the bell at House B. When I explained the problem, the family was very receptive and let me probe the back yard with a Sony ICF-7600 portable shortwave set. The power drop to the house and the breaker box were radiating plenty of 75-meter RF.

We found no obvious "hot spots" inside or outside. I asked if I could turn off the House B main breaker for a minute. They consented, I flipped the breaker, and the noise continued in the portable receiver.

By now, the owner of House A was home, but he was not interested in W6XYZ's plight. "Hams cause all the TV interference problems," he said, "so I don't care if I cause a problem for a ham."

I told him I just wanted to check the

incoming power line in his back yard. "Come back with the Edison Company," he replied, and asked us to leave.

When I told W6XYZ about our experience, he began to despair. He said that he was thinking of selling his house and taking a long trip in his RV. I wasn't ready to give up yet.

To be absolutely sure that House A was the culprit, I did a "porch light survey," reading the signal strength of the 3900 kHz radiation from the front porch light wiring of every house in the neighborhood on the Sony receiver. Sure enough, the light at House A radiated 20 dB more signal than any other.

I tried one more time at the door of House A, this time with W6XYZ along. Despite our best efforts at diplomacy, the owner would not let us into his house or yard, nor would he turn off any breakers for tests.

FCC gets involved

I gathered all the RDF and porch light data. Then I put together copies of my maps of the neighborhood, showing how House A was clearly the RFI source. I wrote a cover letter to the Engineer-in-Charge of the Los Angeles area FCC office, detailing the problem. I pointed out that the 3900 kHz radiation from House A was so great as to be a violation of FCC Part 15, that the owner was uncooperative, and that FCC intervention was needed.

Less than two weeks after sending the letter and data, FCC sent a letter by certified mail to the owner of House A, telling him that he was in violation of Part 15 and had fifteen days to correct the problem. Apparently that really lit his fuse. I heard that he promptly drove to the FCC office and railed against W6XYZ and me. Fortunately, the FCC stood firm.

From that point on, my information is second-hand. I was no longer needed, so I stepped aside. I heard that circuit breaker checks showed the QRM definitely came from House A, and that a bad power line ground and loose cable TV hardware were found and fixed. But the 3900 kHz radiation continued.

Two months later, I heard that an FCC engineer had located the RFI source in the house, and ordered it to be repaired. But by that time, W6XYZ had sold his house and was moving out.

Apparently the malfunctioning device never got fixed. I drove down W6XYZ's old street two years later and heard an unstable carrier on 3900 kHz. If you like 75 meters and are thinking of buying a home in Stanton, contact me first. 73

QRX

continued from page 6

70 centimeters, and 1.2, 2.4, and 5.4 GHz. The actual uplink and downlink frequencies will be determined at a later date.

But that's not all. Unlike the ailing AO-40, this will be a relatively small bird. Thanks to advances in technology, the next generation of ham radio satellites will have a maximum mass of only about 100 kilograms and a power consumption of about 100 watts. Stabilization will be provided by spinning the spacecraft.

This satellite would have a new control system or Internal Housekeeping Unit. In fact it will be a universal design for use in future AMSAT satellites. The reason for a new controller is simple. While the existing design has proven to be very stable, it uses parts that are getting harder and harder to find. AMSAT NA says that the new unit will use more readily available components.

The AMSAT North America Board of Directors made these far-ranging decisions when they met in Orlando, Florida, on February 24th and 25th. At the same time, the AMSAT NA leaders approved the design, construction, and demonstration of a new mode using digital modulation techniques. The AMSAT directors say that this holds the potential of improving communications under very poor conditions or, alternatively, permitting the use of lower power and/or simple antennas with future ham radio birds.

The AMSAT North America Board of Directors did not specify a name for this next generation of ham radio satellite, but it's unofficially known simply as JJ.

And as to why the next satellite won't be left permanently in geostationary orbit? Ham satellites are always international projects requiring the cooperation of hams in AMSAT groups around the world. Even if a place could be found in the equatorial geostationary satellite parking belt, leaving an amateur radio satellite in one place forever would not be fair to those in other nations with hams who contributed to its development and launch.

Thanks to Roy Neal K6DUE, to AMSAT NA, and to VE3FRH, all via Newsline, *Bill Pasternak WA6ITF, editor.*

Take My License — Please!

In what has to be one of the most bizarre enforcement incidents to date, a ham not under investigation has told the FCC he has canceled his own ham radio license.

The now-former ham who took this action is Stephen H. Anderson, the ex-AA8DP of Somerset, Kentucky. Back on January 24th, FCC chief rules enforcer Riley Hollingsworth sent a note off to Anderson asking that he either confirm or deny that he was in control when Technician class licensee Charles Puckett KF4ZMG operated, transmitting on 3.860 MHz — a frequency not authorized under Puckett's Technician-class license. Puckett had earlier told the FCC that Anderson was in control at the times the transmissions had been made.

Nothing out of the ordinary, you say? Well, we will let Riley Hollingsworth tell you what happened next: "The license of Stephen H. Anderson AA8DP, of Somerset, Kentucky, was canceled by the Wireless Bureau after Anderson sent the license into the Enforcement Bureau and informed us that the United States government was a foreign corporation — and that's certainly news to me. He informed us that he did not recognize its jurisdiction and he didn't recognize the jurisdiction of the FCC."

Anderson's letter also told the FCC that he does not reside in any territory or possession of the federal government of the United States of America. As such, says Anderson, he is not "subject to any regulation by this fictitious entity."

The regulatory agency was very understanding. It did not question Anderson's motives or reasons for sending in this letter. It simply canceled his license, and Anderson is no longer a radio amateur in the eyes of the FCC.

Thanks to the FCC, and Bill Burnett KT4SB, via Newsline, *Bill Pasternak WA6ITF, editor.*

Microsoft vs. GM

Word has it that at a computer expo one time, Bill Gates reportedly compared the computer industry with the auto industry and stated: "If GM had kept up with technology like the computer industry has, we would all be driving $25 cars that got 1,000 miles to the gallon."

In response to Bill's comments, General Motors allegedly issued a press release stating:

"If GM had developed technology like Microsoft, we would all be driving cars with the following characteristics:

1. For no reason whatsoever, your car would crash twice a day.
2. Every time they repainted the lines on the road, you would have to buy a new car.
3. Occasionally your car would die on the freeway for no reason, and you would just accept this, restart, and drive on.
4. Occasionally, executing a maneuver such as a left turn would cause your car to shut down, and refuse to restart, in which case you would have to reinstall the engine.
5. Only one person at a time could use the car, unless you bought "Car95/98" or "CarNT," but then you would have to buy more seats.
6. Macintosh would make a car that was powered by the sun, reliable, five times as fast, and twice as easy to drive, but would run on only 5% of the roads.
7. Your oil, water temperature, and alternator warning lights would be replaced by a single "general car fault" warning light.
8. New seats would force everyone to have the same size butt.
9. The airbag system would say "Are you sure?" before going off.

Continued on page 61

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Preventive Brain Surgery for Icom Xcvrs

Trying to resurrect a comatose Icom transceiver can be bad news. Here's how to prevent the dreadful fate in the first place.

In the November 2000 issue of 73, I read with great interest the Hamsats column by Andrew MacAllister W5ACM. The column was titled "If Your Xcvr Goes Brain-Dead."

Normally, since I'm not into ham satellite work, I generally only skim over this column. However, I thought it was an unusual title for the column, and it caught my attention. In addition, I recalled working on a fellow ham's Icom 730 some time ago that had suffered the same fate as the one mentioned in the column.

This past summer, my ham shack and home suffered a powerful lightning strike that took out most of my radios. After the insurance claim was settled, I opted to sell my radios as is. Next, at the Winchester Virginia hamfest, I ran across two mint-condition radios to replace my HF and VHF station. I picked up the Icom 271A and Icom 751. About a month later, I ran across the matching Icom 471A on e-Bay and was the successful bidder. Now I'm the proud owner of three of these venerable Icom rigs, which also have the potential to suffer from this electronic form of Alzheimer's disease.

Since all three radios were working fine, I didn't really see the need to invest in about $200 worth of EPROM for the three rigs. I also was concerned that since the radios were about 10–12 years old, and had the original Icom batteries, that I was awaiting the inevitable if something was not done.

A search of the Internet uncovered some old E-mail postings on a few ham Web sites concerning the problem. I found one that appeared to address the prevention of the failed memory problem, and discussed how to change the battery on the RAM board. The instructions, however, contained no illustrations, and were not

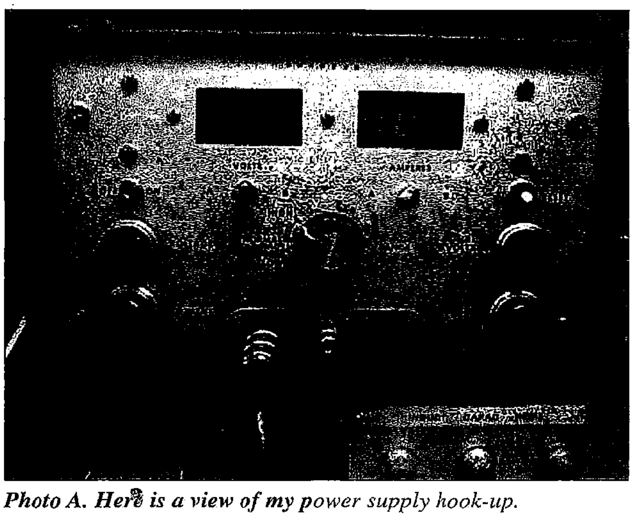

Photo A. *Here is a view of my power supply hook-up.*

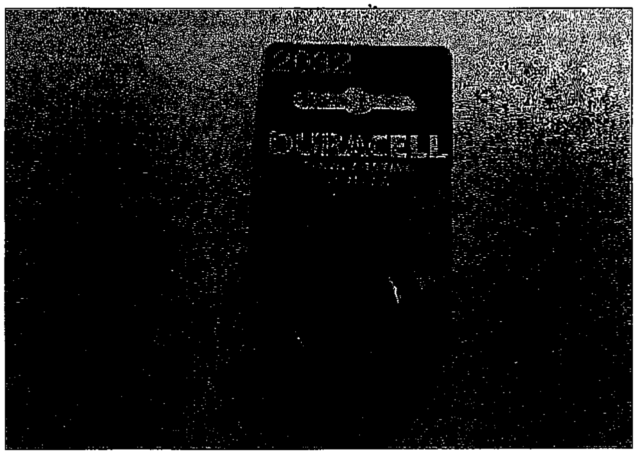

Photo B. *Lithium coin cells such as this CR2032 are available from most any retail store such as Wal-Mart or Radio Shack.*

the clearest and easiest to read. After pondering through them several times, and looking over my Icom 271A, I decided to try the procedure.

Here below are the results of my battery replacement, and a modified procedure, complete with illustrations of what to do. This procedure was used on my Icom IC-271A, IC-471A, and IC-751. It should work on most any Icom rig made in the 1980s and 1990s that uses a similar RAM board. These include all of the IC-x71 series, and some other radios as well, like the IC-751/751A.

What you'll need

First, let me say that this procedure will not help you if your battery has gone dead. You'll need to follow one of the suggested routes in the November 2000 Hamsats column. Also, beware that if you are not careful, you could wipe out your RAM backup if you fail to follow the procedure correctly or if a slip-up occurs, such as shorting out the battery or power supply terminals. Hence, caveat emptor, and proceed at your own risk.

To start with, you'll need the following items: a regulated five-volt power source, with leads to connect to the RAM board. Test leads to connect to the RAM board, once it's removed. I recommend something that will stay firmly connected, such as EZ-Hooks–type grabber leads, since these will be much less prone to coming loose. If they come loose while the battery is being removed, then the RAM will be wiped out, and you'll have a brain-dead radio. **Photo A** shows a picture of my power supply hookup.

You'll also need a small soldering iron, a few short lengths of red and black hookup wire, and a lithium coin cell, CR2032, available from most any retail store such as Wal-Mart or Radio Shack (see **Photo B**). Note the date code. In this case, the battery has a guaranteed shelf life until March 2005. In all likelihood, the battery will last 10 years, but to be safe, I'll plan on replacing mine every five years.

To make future battery change out a snap, you'll need a battery holder. A suitable holder is available from many mail order sources, as well as at Radio Shack, catalog number 270-430, lithium battery holder. This is an off-the-shelf stock item that has solder tabs for PC board mounting. By going ahead and installing this now, when 2005 rolls around, all that will be needed is to power up the radio, and change out the battery while the rig is turned on. This will greatly simplify future battery replacements. Hence, if you follow this procedure, the bulk of the work required has to be performed only once!

Doing the upgrade

First, take your rig where you'll have space to work on it. I suggest laying it on a soft cloth or piece of carpet while you work on it, so as not to scratch the case. In the x71 series, first

Photo C. This is the smaller PC board with the quarter-sized battery near the bottom of the photo.

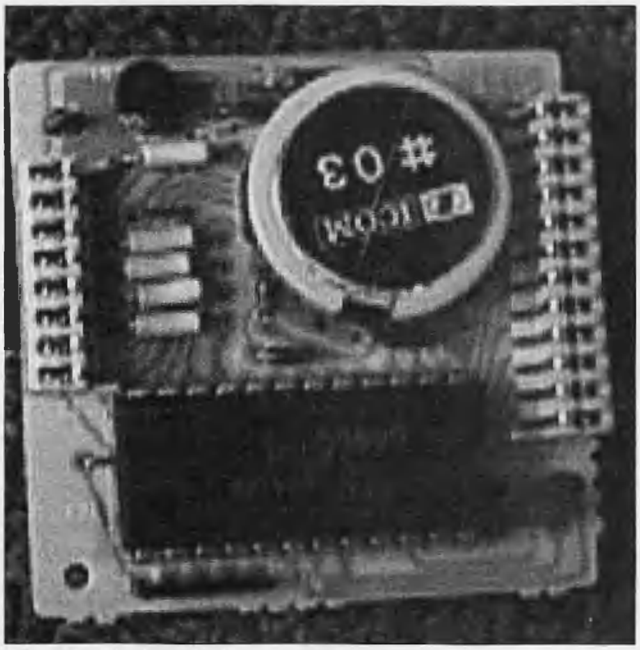

Photo D. The board after it is removed.

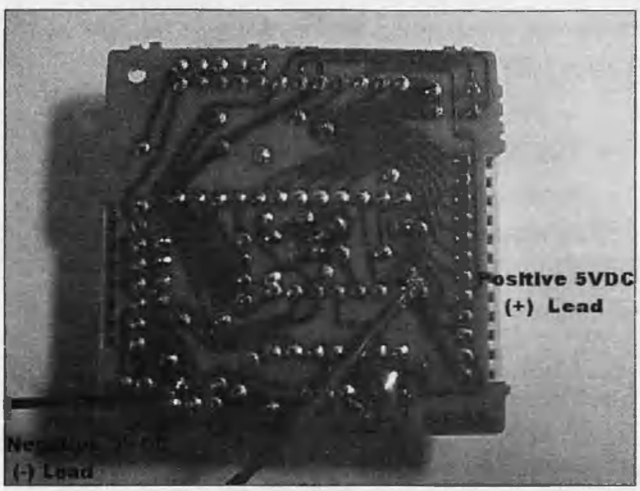

Photo E. Attach the temporary 5 VDC power leads as shown.

you must remove the top cover on the rig, via several Phillips-head screws. The bottom cover is partially recessed into the top cover — hence the need to remove both top and bottom cover to get to the RAM board, which is located in the bottom of the rig.

Turn the rig upside down, and remove the bottom cover. You'll need to locate a small PC board mounted on top of a larger board. This small board has a battery attached to it. See **Photo C**. Here, you see the smaller PC board with the quarter-size battery near the bottom of the photo.

The whole board will need to be removed to get at the battery. To do this, carefully pull up on the board to remove it. It is held in place by two rows of push-on contact pins, and will pull off. Note that the two rows of contact pins are different lengths, which ensures that the board can only be installed one way. **Photo D** shows the board after it is removed.

Now, we will need to tack-solder some wires onto the board, to provide 5 VDC to keep the RAM backed up while we remove and replace the battery. Orient the RAM board as shown in **Photo E**, which shows where to solder these temporary 5 VDC power leads. The +5 VDC lead is the lead shown attached on the right side of the photo, and is just to the left of the longer contact socket.

The negative lead connects to the bottom left corner of the board, just to the right of the smaller contact socket. Now, connect the 5 VDC power source to the temporary leads we just installed. Observe proper polarity. Again, let me stress the need to be sure your power supply leads are firmly connected to these two temporary leads. You'll have to rotate the board and flip it over a few times in the next steps, and you don't want to lose your power connection!

Now, you'll need to grab a soldering iron and some desoldering braid. Locate the tabs holding the lithium battery to the board, and unsolder these tabs. Before removing the old battery, note which solder tab is positive and which one is negative. Remove the battery. In its place, insert the lithium coin cell holder, being sure to reconnect the new battery holder in the proper polarity (positive lead of the holder to the hole on the PC board where the battery positive was connected). Do the same for the negative lead. With the Radio Shack holder, it will be necessary to remove one of the extra solder tabs from the holder. The holder has three tabs, and only two are used (one negative and one positive).

Solder the holder in place. Insert the new CR2032 lithium coin cell in the battery holder. Install the battery with the polarity as indicated on the holder. See **Photo F**. Now, flip the board back over. Take a DVM, and measure the battery voltage at the PC board where the new holder was just installed. It should be around 3 VDC. Again, observe that the battery is connected to the PC board with proper polarity

If you did not read 3 VDC, check to be sure your new battery is good, that your battery is installed correctly, and that there are no cold solder joints.

Assuming all is well with the DVM voltage check, we can now remove the power supply. Cut off the supply,

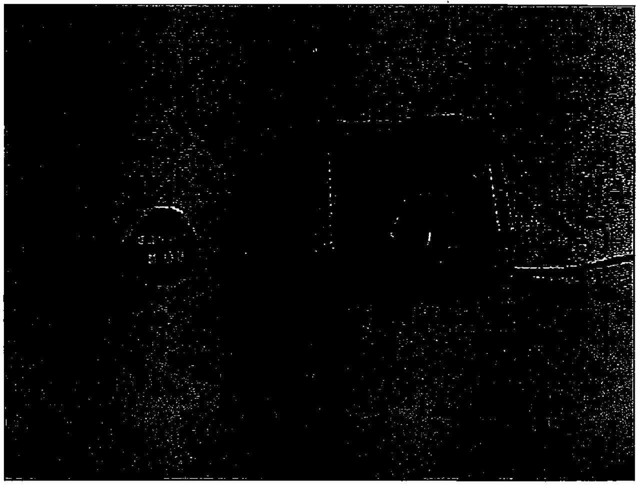

Photo F. Insert the new CR2032 lithium coin cell in the battery holder. Install the battery with the polarity as indicated on the holder.

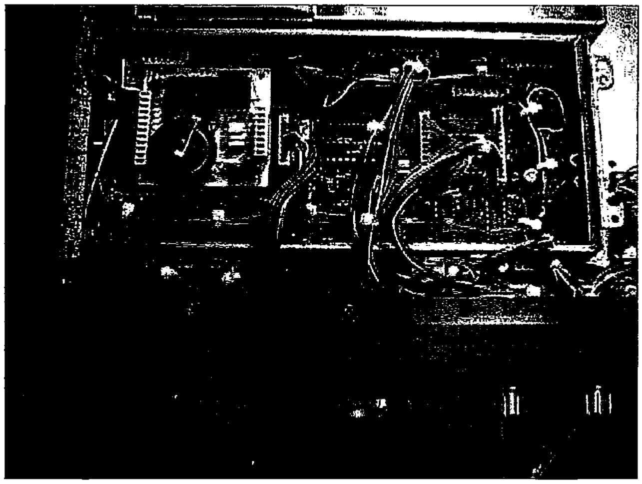

Photo G. Here is the newly installed board. Turn the radio on and test it before replacing the covers.

remove the test leads, and then unsolder the temporary leads installed on the RAM board.

Finishing up

We're almost finished. Reinstall the board back into the radio. Be careful not to pinch any wires under the RAM board when you reinstall it. The first time I did, I pinched one of the wires on the main board below, and it caused my S meter to stay pegged. Removing and reseating the board while pushing the wire on the main board out of the way cured that.

At this point, I'd suggest turning your radio on, and testing it before replacing the covers, just in case. All functions should work normally, and any memory channels that were saved before beginning should still work. **Photo G** shows the newly installed board. Reinstall the covers, and your rig should be ready to go.

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Air Hamtronics

If you're a pilot, this aviation receiver should be in your flight plan.

It is remarkable to see the number of radio amateurs who also possess a pilot's license of one type or another. Man or woman, it doesn't matter. The internal makeup of someone who enjoys sitting for hours in front of dials, gauges, meters, etc., while carrying on a conversation logically progresses to those who like to do the very same thing while hurtling themselves through the air. If you buy that, then it should be no surprise that we at 73 would like to review an aviation-related product for you which comes from our good friend Jerry Vogt at Hamtronics, Inc.

Jerry and his team have recently developed a product that dovetails the interests of the experimenter and the pilot that exist in so many of us. Their new product is the R121. An air-band receiver it is, but that's where the similarity ends between this product and something you might find dangling from someone's belt, or hidden somewhere in a flight bag. This is a rugged, dependable device that is intended to serve a couple of very important functional applications. The benefits from this little box do not stop there, however. You need only exercise your imagination, especially when confronted by the cost of just about everything associated with aviation (let's not go there, OK?), to understand how important the relatively low price tag on this rig is, too.

The point that I seem to be circling to land upon is that Jerry and company have brought to market a robust receiver that fits nicely into the hands and budgets of rural airport operators, search and rescue (SAR) aircraft owners, and just about anyone else that has a desire to tinker with and dream about what they would like to do with their experimental aircraft.

Functional specifications

I have left you hanging long enough. It's time to talk about what this thing is, and what it does. The R121 is a mature, low-tech (and that's good, by the

Photo A. *This is the front view of Hamtronics' new R121 programmable air-band receiver*

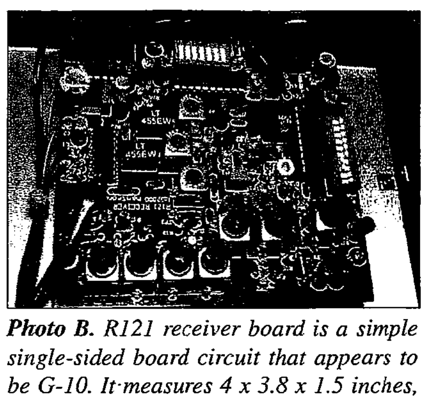


Photo B. *R121 receiver board is a simple single-sided board circuit that appears to be G-10. It measures 4 x 3.8 x 1.5 inches, with the volume and squelch controls protruding forward. All components and test points are easily identifiable, with the exception of the MC145190F synthesizer chip, which is mounted on the foil side as it is a surface-mount device.*

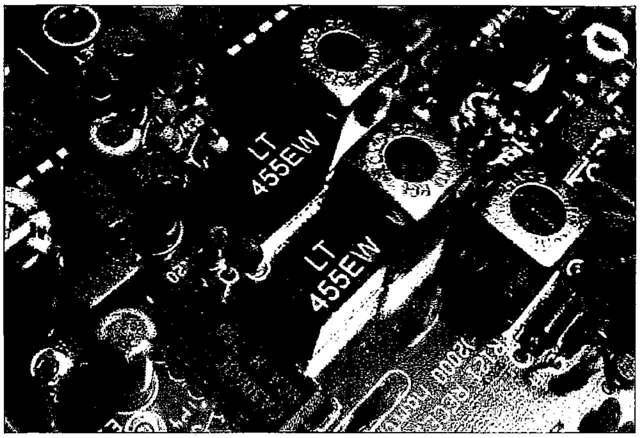


Photo C. Here is a close-up shot of the 455 kHz IF and detector. Even an over-50 Norwegian with "short-arms disease" like me can actually REPAIR something on this scale. Way cool!!

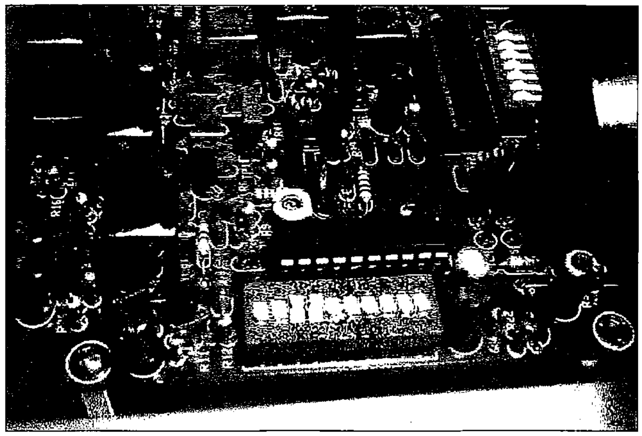


Photo D. Here is a close-up of the synthesizer programming switch. The function switch is in the upper right-hand corner of the photo.

way), double-conversion receiver that is programmable from 118 to 137 MHz. The receiver consumes between 75 and 200 mA (full audio output) at 13.6 VDC. Its baseline frequency stability is +/- 2 ppm all the way from –30 to +50 degrees C. It employs a standard CA3088 amplifier/AM detector, and will provide 2 watts of audio to an 8-ohm speaker, while providing a 10 dB signal-to-noise ratio at 0.2 microvolts. Trust me, I tested it. The one I evaluated was closer to 0.18 microvolts at 121.775 MHz (some of you CAP types should recognize that frequency). The R121 also employs a pair of inexpensive, easy-to-obtain 3SK122 dual-gate MOSFETs in the front end and mixer. One very nice thing is the adjacent channel selectivity of 80 dB. This is very important if you are going to use any receiver around an airport.

The R121 will also provide the user with a relative signal strength indication by driving 1 mA full-scale meter. The synthesizer is DIP-switch programmable in 25 kHz steps. A simple MC68HC705J1A microprocessor interprets the switch settings for the synthesizer. You can tell that Jerry didn't design this receiver for the average scanner listener, as you actually have to do some math to program the receive frequency. This is not rocket science (I hate that term), and Jerry provides the owner with a very simple technique in his well-written manual for setting the R121 on the desired channel. If you have access to the Internet, you can go to the Hamtronics, Inc., Web page to obtain switch settings for every frequency that the R121 will tune to (the URL is at the end of this article).

Functions and applications

I mentioned earlier that Jerry and his team developed this receiver around two main applications. These are, but are certainly not limited to, airport runway lighting control, and emergency locator transmitter (ELT) detection and tracking. Actually, there are two other modes available: a simple monitor mode, and a test mode. All of these are DIP-switch-settable. A second 705J1A µP chip controls the timing functions, and drives the three open-collector outputs (2N3904) that are provided for the alarm and control features. The S-meter output is an unbuffered output that comes directly from the detector chip.

Pilot control of runway lighting (PCL) mode

For many years now, airport operators have sought to conserve energy by not leaving the runway lights up at full strength, especially during low-use, or non-tower-controlled periods. What a pilot may do is key his or her transmitter on the common traffic advisory frequency (CTAF) either three, five, or seven times within a five-second period to get low, medium, or full intensity runway lights functioning on the airport without ground intervention. Nope, nobody has to go out and light the smudge pots anymore, when you want to come in for a night landing. All you need now is an R121 driving the lighting controls at your airport. The three open-collector outputs may be used to drive a variable intensity lighting relay system at your home airport, or even at Boeing Field for that matter.

ELT detection and tracking mode

This mode is near and dear to my heart. I own a PA28-140B with a 160 HP Penn Yan conversion that I use for flying SAR missions for the State of Washington, and for the CAP (I'm also my squadron's communications officer). ELT search missions happen a lot around here, and I am sure that they do where you are as well. In the CAP corporate aircraft here in Washington Wing we leave a receiver on 121.5 all the time the avionics master switch is on. I am not so blessed with the appropriate hardware in my Cherokee, but I intend to remedy that situation. The R121 is an excellent candidate for that.

The fact is that the R121 may be used in a fixed base operator's (FBO) location to see if any of the ramp angels or hanger queens are chirping away on 121.5 after good hard student landing. It may also be used in a ground team search vehicle equipped

Continued on page 46

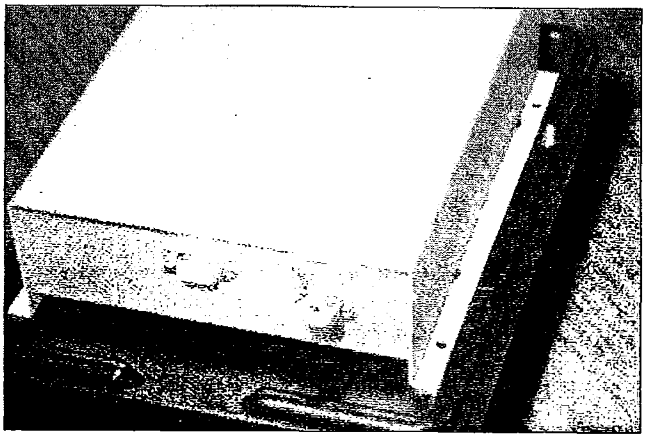


Photo E. The rear panel provides an SO-239 connector for RF, and a DB9 connector for power, audio, and control outputs.

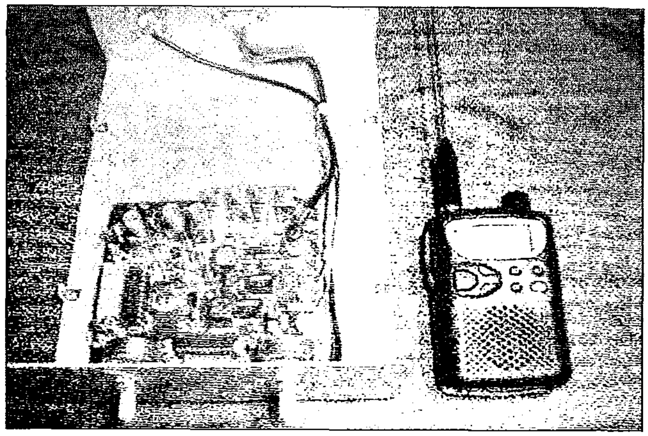


Photo F. Here is an idea of the size of the R121. On the right is my tiny little ICQ7A.

Air Hamtronics

continued from page 45

with DF equipment, or as a dedicated DF receiver in an aircraft.

In the ELT mode, the receiver can be set up to monitor 121.5, and can also provide a delayed alarm that is programmable in 5-minute increments up to 75 minutes. This is to prevent an accidental alarm trip during the FAA-allowed ELT test period of each hour. The alarm feature is facilitated by the µP and open-collector circuits, and is programmed by the mode switch. This can be very useful for alerting the pilot and scanner to an ELT activation if the audio is turned down, and may be used to feed audio and a signal strength reading to the DF gear in either a vehicle or aircraft. The R121 then becomes a piece of mission-critical hardware for SAR work. The possible applications don't end there, however. Like I said before, just use your imagination.

Wrap-up

I really like this receiver. It is a very simple, mature design that is both rugged and easy to work on. It can be easily 337'd into my Cherokee as a dedicated ELT receiver, conveniently placed out of sight, and away from passengers, hardware, or rigging.

The R121 is currently available from Hamtronics in two ways. Their current pricing indicates that it may be obtained wired and tested in a circuit-board-only configuration for $209, or may be purchased in a very solid anodized aluminum case for $299.

For more information, I suggest you contact the manufacturer directly. Their address is Hamtronics, Inc., 65 Moul Road, Hilton NY 14468-9535. Their phone number is (716) 392-9430. If you have access to the Internet, their URL is [http://www.hamtronics.com]. You can communicate with Jerry directly at [jv@hamtronics.com].

Now, let's see if Jerry forgets to ask me to send this little box back. I might be tempted to stick it under the back seat tray in my little "Volkswagen-with-wings." 73

Mobile, Portable and Emergency Operation

Steve Nowak KE8YN/Ø
16717 Hickory St.
Omaha NE 68130
[ke8yn@netzero.net]

Just What Does "Amateur" Mean?

One of the things I like most about amateur radio is the fact that it really and truly is an amateur activity. Professionals get paid for performing a particular function. We amateurs, on the other hand, are specifically prohibited from accepting compensation for providing radio services in the amateur bands. This, by definition, is what makes us amateurs.

Being amateurs does not mean that what we do has no value, and in many cases we provide significant value to our neighbors and community. Many amateur radio public service liaisons calculate what our services would cost if someone provided it on a fee-for-service basis. For example, if amateurs weren't available, what would it cost to provide fully trained and equipped communicators? The local government could be charged thousands of dollars for the communications support. As amateurs we provide the service for free.

Sometimes it's the word "amateur" that gets in the way. It sounds like a second-class citizen. We have an expectation that a professional who makes his livelihood from his activity naturally takes pride in how he performs. An "amateur" might not be expected to perform to the same high standard. In practice, however, amateurs provide some of the highest-quality service on the airwaves; but that word creates certain images.

The big difference is that as amateurs we engage in amateur radio for a different reason than our professional counterparts. We do not engage in communications for money. We don't get involved because we have to. We develop our skills, pass our license exams, and acquire a selection of equipment because we enjoy it. Nothing more, nothing less. Amateur radio is a labor of love. We are after the enjoyment, fulfillment, and just plain fun that the hobby provides. I enjoy my job, but if I found I had a winning lottery ticket, I'm not sure I would wish to continue to work. On the other hand, I have no doubt that I would continue to enjoy ham radio. In fact, I can only imagine the ham radio toys that I would buy if I in fact won the lottery!

I think this is why there are so many aspects to the hobby. There is virtually something for everyone. Of course, there would have to be in order to keep so many people interested. We come from all walks of life, all career paths, all education levels, and all parts of the world. Each of us, out of love for the hobby, finds a niche that pleases us, keeps us interested, and provides a little break at the end of the day or on the weekend.

What we do may not make sense to others, and sometimes may not make sense even to us. We do certain things because we can — not because we must. To many people (both amateur and non-amateur) communicating by Morse code is a quaint but obsolete curiosity. To some hams, it is the ONLY way they truly enjoy the hobby. There is no reason to work CW except for pure love of the mode. I know CW can get through when other modes fail. I know that a QRP rig works best with CW. But let's face it — you gotta love it or you'll choose another mode.

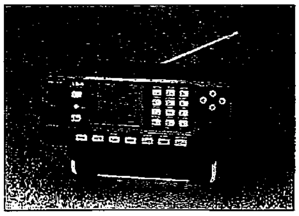
Some hams love to design and build equipment, even though excellent factory-assembled equipment is readily available. The off-the-shelf equipment may have significantly better features, but it is the pure enjoyment of building that drives some of us. Then there are those of us who prefer the challenge of making global contacts by various inefficient and unreliable methods. Why would a rational human being bother with a contact via meteor scatter or earth-moon-earth bounce when the telephone and Internet access are within reach. Why? Because it's fun. Like hunters used to say, "The thrill of the hunt is in the chase, not the kill."

Every once in a while, when the hobby becomes a little too routine, it's good to stop and remind yourself that this is a hobby and we do enjoy it. I enjoy it more than any other hobby I've attempted, but still find it important to stop and smell the roses (or maybe I should say the rosin flux).

What aspects of ham radio hit your ON button? What makes you glad to be an amateur? What do you do for the pure love of the hobby? Is there something that excites you, or has it become just a habit? Is mobile operations what you participate in the most? If so, what is it about the mobile operations that you particularly enjoy? Is it the ability to chat with the same group on a regular basis? Maybe it's just some way to pass the time on the way to and from work. How about the chance to speak with hams around the world while on a trip? On the other hand, it might just be that mobile operations characterize your only available time to spend with the hobby.

As you know, I enjoy public service and disaster communications. Given that my career is in health care, there seems to be a natural fit. Because of my interest in these areas, the reliance on mobile and portable operations is a natural progression, since both are critical in the effective management of an emergency situation. On the other hand, for the few days each year that I'm involved in public service communications, there are hundreds when the hobby is there just for the fun of it.

I'm suggesting that each of us take a few minutes to look at the hobby with a fresh perspective and think about some aspect of it that might be fun. I mean *real* fun, and preferably something that we've never tried. It could be a new mode or a different band. If you're not a contester, then maybe try a contest. How long has it been since you participated in Field Day? If it's been a few years, then maybe that's a possibility. Choose something just because it sounds fun. When you do, give it a try and drop me a note as to how it went!



AOR AR8600 Wide-Range Receiver

"The AR8600 reflects a blend of advanced technology, innovative thinking, and some proven techniques in giving the operator a world of listening choices and options," said Taka Nakayama, vice president for AOR USA. "The AR8600 is so advanced, its design has been awarded U.S patent 6,002,924. It can accommodate optional cards that allow the user to add extended features, and it can accept Collins mechanical filters for amazing selectivity."

The AR8600 has a Temperature-Compensated Crystal Oscillator (TCXO) as an extremely stable frequency reference. It can hold up to 1,000 memories (20 banks x 50 channels/bank) and can search those memories for signals at a rate up to 37 channels per second. In addition, there are 40 different search banks. Tuning range is 520 kHz—2.040 GHz. By law, cellular frequencies are blocked, but an unblocked version of the AR8600 is available to qualified agencies.

Receive modes include wide FM, narrow FM, super-narrow FM, wide AM, narrow AM, upper sideband, lower sideband, and continuous wave. Received signals are processed through a newly designed front end. There are three operating modes: VFO (featuring two independent VFOs), Memory, and Search.

Innovative features include an area for up to three optional slot cards that perform various functions, including: CTCSS, Tone Eliminator, Voice Inversion, Digital Recording, and External Memory. In addition, optional Collins mechanical filters can be added for precise selectivity.

In the wide FM mode, the AR8600 can use its 10.7 MHz IF output in conjunction with the SDU5500 Spectrum Display Unit. The AR8600 can also display spectrum activity on its front-panel display.

Computer management of the AR8600 is done through a rear-panel RS-232C port, and free software for controlling the unit is available from the AOR Web site, [http://www.aorusa.com]. Each memory can store frequency and an array of special choices, including alphanumeric channel labeling.

Front panel controls include power switch, a multifunction keypad for direct frequency entry and secondary functions. Additional controls include volume, squelch, operating modes (VFO, Memory, or Search), keyboard lock, and an "arrow matrix" to aid in menu choices. There is also a front panel connection for headphones.

The AR8600 comes with a movable front support and a BNC antenna port with telescoping antenna, and operates on 12 volts DC from a power cube or station power supply.

"The AR8600 is a strong advancement in receiver technology," said Mr. Nakayama. "We believe there will be a strong demand for it by commercial and institutional operators as well as those listening enthusiasts who demand the best."

For further information, contact AOR U.S.A., Inc., 20655 S. Western Ave., Suite 112, Torrance, CA 90501; tel.: (310) 787-8615; fax: (310) 787-8619.

Buckmaster's HamCall CD-ROM

This disk gives you over 1,635,000 US and international callsigns. Features include ability to view and search interest profiles for over 35,000 hams; search for club, military, RACES, vanity, and silent keys; access over 122,000 E-mail addresses; get latitude and longitude for over 90% of all addresses, with precision down to a few hundred feet; see flag and map for each country; see ITU zone and continent; print labels for QSLs; interface with most popular logging programs; edit entry information; and much more. $50, plus $5 s/h USA, $8 s/h international. Update service and on-line advanced search services also available for additional fee.

For further information, contact Buckmaster Publishing, 6196 Jefferson Highway, Mineral VA 23117; tel. (800) 282-5628; E-mail: info@buck.com

News from Kenwood

• Kenwood has published a new video for club (only) presentations about its new multiband/multimode TS-2000 transceiver. The video describes this latest state of the art equipment that allows operation in many different configurations, including mobile, personal computer, and spinning the traditional VFO. The short video is a great addition to any club meeting. You can request one on a club letterhead including UPS address from Kenwood Amateur Group Video Offer, 3975 Johns Creek Ct. #300, Suwanee GA 30024 or by faxing (678) 474-4730. For US ham clubs only, please.

• Kenwood has announced that it has contracted with INSINC, Interactive Netcasting Systems, Inc., to broadcast live events during the Dayton Hamvention (May 18–20) using the power of the Internet. For the first time, hams around the globe can attend activities at Dayton and hear interviews with the real movers and shakers of amateur radio. Watch [www.kenwood.net] for more details.

Hamcalc Version 50 Released

V. 50 of Hamcalc has now been released. Details on this disk can be found in our February "New Products" column.

For a free Hamcalc CD-ROM, please send US $7.00 in check or money order (no stamps or IRCs, please), to cover cost of materials and airmail to anywhere in the world, to George Murphy VE3ERP, 77 McKenzie St., Orillia ON L3V 6A6, Canada. E-mail: [ve3erp@encode.com].

Listings are free of charge as space permits. Please send us your Calendar Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the August issue, we should receive it by June 5. Provide a clear, concise summary of the essential details about your Calendar Event.

MAY 5

CADILLAC, MI The Wexaukee ARC will hold their 39th Annual Amateur Radio and Computer Swap Meet on Saturday, May 5th, from 8 a.m.–12 p.m. at the Cadillac Junior High School in Cadillac MI. Talk-in on 146.980/ K8CAD rptr. Free parking. Admission is $5, tables $8 per 8 ft. table. VE exams at 10:30 a.m., by pre-registration only; contact *Alton NU8L (231) 862-3774* or E-mail *[amcconnell3@hotmail.com]*. For more info please write to *The Wexaukee ARC, P.O. Box 163, Cadillac MI 49601.*

CEDARBURG, WI The Ozaukee Radio Club will sponsor its 23rd Annual Cedarburg Swapfest, 8 a.m.–1 p.m. at the Circle-B Recreation Center, Hwy. 60 and County I (located 20 miles north of Milwaukee, west of Grafton). Admission is $4, both in advance and at the door. 4 ft. tables are $5 each (limited power available on request). Seller's setup 6:30 a.m. VE exams start at 9 a.m. Talk-in on 146.37/ .97 and 146.52. For tickets, table reservations, maps, or additional info, send an SASE to *Gene Szudrowitz KB9VJP, ORC Swapfest Chairman, W55 N865 Cedar Ridge Dr., Cedarburg WI 53012. Tel. (262) 377-6792;* or *Skip Douglas at (262) 284-3271.*

MAY 5–6

ABILENE, TX The Key City ARC will sponsor the ARRL West Texas Section Convention and 16th annual Hamfest at the Abilene Civic Center from 8 a.m.–5 p.m. Saturday, and from 9 a.m.–2 p.m. Sunday. Free parking. VE exams. Wheelchair access. Limited RV parking for a nominal fee. Tables $7 each. Pre-registration $7 (must be received by April 30th), $8 at the door. Talk-in on 146.160/.760. For reservations and info contact *Peg Richard KA4UPA, 1442 Lakeside Dr., Abilene TX 79602. Tel. (915) 672-8889; E-mail [ka4upa@arrl.net].*

MAY 12

RENO, NV The Reno Area Metro Simplex ARC will sponsor the Reno Spring Ham Swap at Television Station KNPB, 1670 N. Virginia St. (on the campus of the Univ. of Nevada, Reno). From I-80, take the Virginia St. exit and head north one mile. Free admission to all. Vendors, bring your own tables. Large indoor/ outdoor swap. Plenty of parking. Tours will be given of the High Definition TV Station. For VE exams, contact *Don Freeman W7FD, (775) 851-1176; or [dfree1@worldnet.att.net].* Talk-in on 147.060(+123). For more info contact *Glen Haggard KK7IH, (775) 673-6401; [kk7ih@nvrams.org].*

MAY 27

WEST FRIENDSHIP, MD The Maryland FM Assn., Inc., will host its Memorial Day Hamfest, Sunday, May 27th, at the Howard County Fair Grounds, Rt. #144, West Friendship MD, 8 a.m.–2:30 p.m. The premises MUST be cleared by 5 p.m. Talk-in on WA3DZD/R rptr., 146.16/.76, 223.16/224.76, and 449.0/444.0. Plenty of food and drink will be supplied by the West Friendship 4-H. No private sale of food or drink permitted. Donation $5. Tailgaters $5 per space. Inside table rentals $20 in advance, $25 al the hamfest. Only paid reservations are valid. No pay, no reservation. For info and reservations, contact *Craig Rockenbauch WA3TID, 429 Severnside Dr., Severna Park MD 21146. Tel. (410) 987-6042.* Make checks payable to MFMA, Inc. All proceeds will be used for amateur radio related purposes. Commercial vendors must have proper tax/license certificates available. All items offered for sale must be amateur radio–related.

JUNE 2

SPRINGFIELD, IL The Sangamon Valley Radio Club Hamfest will be held at the Illinois State Fairgrounds Cooperative Extension Building in Springfield, rain or shine. From I-55 take Sangamon Ave. west to the Illinois State Fairgrounds. Stay on Sangamon Ave. past the main gate. Go to the next gate (Gate 11). Enter Gate 11 and drive straight back to the Cooperative Extension Building. Talk-in on 146.685 MHz(-.600). Tickets $5 each, or 3 for $10. No additional charge to set up in the 100,000 sq. foot covered flea market area. Limited indoor tables may be available. Contact *Ed Gaffney KA9ETP, 13977 Frazee Rd., Box 14A, Divernon IL 62530; tel. (217) 628-3697; or E-mail [egaffney@family-net.net].* For more info about the Sangamon Valley RC, this hamfest, or obtaining an amateur radio license, please visit *[WWW.W9DUA.NET].* This ham- fest is co-sponsored by Shooting Stars 4-H. Food service provided by Shooting Stars 4-H.

JUNE 3

CHELSEA, MI The 23rd Annual Chelsea Swap, Ham and Antique Radio Swap, will be held on June 3rd in Chelsea MI, at the Chelsea Fairgrounds, on Old US 12 at M-52 in Chelsea. Gates open at 6 a.m. for sellers; 8 a.m. for the public. Donation is $4 in advance, $5 at the door; under 12 free. Plenty of parking; easy access from I-94. Talk-in on 145.450(-), WD8IEL Chelsea rptr. Trunk sales $5 a space. Table space, $10 per 8-ft. table. Handicap access. For reservations and more info, E-mail *[WD8IEL@hotmail.com];* or contact *Bill Altenberndt WB8HSN, 19501 Bush Rd., Chelsea MI 48118.* Sponsored by the Chelsea ARC, Inc.

MANASSAS, VA Virginia's Ole Fashioned Manassas Hamfest, amateur radio, computer and electronics show, will be presented by the Ole Virginia Hams ARC, Inc., at Prince William County Fairgrounds, 1/2 mile south of Manassas, on Rte. 234. Talk-in on 146.97(-), 224.660(-), and 442.200(+). General admission is $5 per person at the gate. No advance sale. Gates open at 7 a.m. Free parking. Indoor exhibitor space with 8-ft tables, $30 each with chairs and electricity. Tailgating $5 per space (plus admission), gates open at 6 a.m. Setups 2 p.m.–10 p.m. Saturday, June 2nd. Ample room for everyone. For VE exams, contact Ruth KU4WH, tel. (703) 331-1234; or E-mail [Frizzy2@aol.com]. Features: ARRL Roanoke Div. officers and 4th Call Area QSL Bureau reps will be present; DXCC QSL card checking; Virginia QSO Party Awards Ceremony. Food vendors must have prior written approval from the Hamfest Chairman. For dealer info, contact *Jack N4YIC, tel. (703) 335-9139; fax (703) 330-7987; E-mail [N4YIC@arrl.net] or [patnjack@erols.com].* For general info, contact *Mary Lu KB4EFP, tel. (703) 369-2877, E-mail [mblasd1638@aol.com].*

JUNE 10

BETHPAGE, NY The LIMARC Spring 2001 Electronics Hamfair and Flea Market will be held at Briarcliffe College, 1055 Stewart Ave., Bethpage NY, beginning at 8:30 a.m. Gates open at 7 a.m. for vendors. General admission is $6, children 12 and under accompanied by a paying parent, and non-ham sweethearts will be admitted free. For more info, visit the *LIMARC Web site at [http://www.limarc.org],*

or call the 24-hour info line at (516) 520-9311. Talk-in on the 146.850 rptr. PL 136.5. *E-mail [hamfest@limarc.org].*

WHEATON, IL The Six Meter Club of Chicago, Inc., will hold its 44th Annual Hamfest, a ham radio and electronic flea market which also features antique and vintage radios. The event will take place Sunday, June 10th, at DuPage County Fairgrounds, 2015 Manchester Rd. (north of Roosevelt Rd. (Rte. 38), east of County Farm Rd.). This hamfest will be held rain or shine. ARRL and dealer displays. Free parking, no extra charge for space in outdoor flea market. Limited overnight RV parking with electrical hookup — $10 each by advance registration, required by May 25th. Advance tickets $5 each, $6 at the gate. Advance tickets available from *Joseph Gutwein WA9RIJ, 7109 Blackburn Ave., Downers Grove IL 60516,* or any club member. For info call the *24-hour InfoLine at (708) 442-4961.* General parking at the West Gate; sellers ONLY at the East Gate. Handicap parking, use East Gate. Gates open at 7 a.m., buildings open to the public at 8 a.m. Talk-in on K9ONA 146.52 or K9ONA/R 146.37/.97 (107.2). Commercial tables 8 ft. w/ 110V in main bldg., air cond., $12 before April 30th, $15 after. Indoor flea market tables, 8 ft., no electric, $10 before April 30th, $12 after. ARRL VE exams 9 a.m.–11 a.m.; call the InfoLine to pre-register for testing. Make check payable to *Six Meter Club of Chicago,* and send with SASE to *Six Meter Club of Chicago, 7109 Blackburn Ave., Downers Grove IL 60516,* no later than May 25th. Absolutely no alcoholic beverages permitted. All sellers are responsible for cleanup of their spaces. No sales of food or beverages permitted.

JUNE 16

DUNELLEN, NJ W2QW, The Raritan Valley Radio Club of Martinsville NJ, will hold a Hamfest at Columbia Park, near the intersection of Routes 529 and 28, 7 a.m.–2 p.m., June 16th. Sellers set up at 6 a.m. Admission: Buyers $5, sellers $10 ($5 each additional space). Talk-in on 146.625(r), 447.250(r), 447.250(r) tone 141.3, and 146.520 simplex. Contact *Doug Benner W2NJH, (732) 469-9009, [WB2NJH@AOL.COM); or Fred Werner KB2HZO, (732) 968-7789, before 8 p.m.*

JULY 4

BRESSLER, PA The Harrisburg Radio Amateur Club, W3UU, will hold its Firecracker Hamfest in celebration of its 29th year, at Emerick Cibort Park, Bressler PA. Set up on July 3rd from 6 p.m.–9 p.m., or July 4th at 6 a.m. The park opens to the general public at 8 a.m. July 4th. 80 covered tables, all with electricity, only $12 each, prepaid by June 1st. All tables paid for after July 1st will be $15 each, prepaid on a first come first served basis. 48 hour cancellation notice required for refunds. Contact *Pete deVolpi K3PD, 408 Hillside Ave., New Cumberland PA 17070. Weekday phone (717) 705-1370, weekends and evenings 6–9 p.m. (717) 938-8249. E-mail [w3uu@aol.com].* See the Web site at *[http://members.aol.com/w3uu/].*

SPECIAL EVENTS, ETC.

CIS DIPLOMA The Radio Amateur's Diploma of the Commonwealth of Independent States, is established by International Radioamateur's Club "Funkner DX Family," to promote a greater amateur radio interest in republics of the Commonwealth of Independent States. The diploma is available to licensed amateurs and to shortwave listeners, and given for working and/or hearing 12 amateur radio stations in all of the 12 countries of CIS: 4K — Azerbaijan; 4L — Georgia; EK — Armenia; ER — Moldova; EU — Belarus; EX — Kyrgyzstan; EY — Tajikistan; EZ — Turkmenistan; R — Russia; UK — Uzbekistan; UN — Kazakhstan; and UR — Ukraine. All contacts must have been made by any mode on any bands, according to the license of the competitor, since January 1st, 1993. QSL cards are not required. The application for obtaining the diploma is verified by the statements of the log. The manager of the diploma reserves the right to test the validity of any reported QSO. The cost of the diploma for the radio amateurs of the Russian Federation is an equivalent 2 US at the rate of the Central Bank of Russian Federation at the date of the application; for radio amateurs from other republics of CIS, equivalent of 3 US; for the radio amateurs of other countries, 6 US. The payment in IRC on a relationship of 1 US = 2 IRC is possible. An equivalent are the rubles of the Russian Federation. The application for the diploma, together with the payment, should be sent to *Funkner DX Family, P.O. Box 50, Moscow 109439 Russia.* Any problems concerning the diploma can be decided on the air through operators of the Club Station RZ3DZZ, or via E-mail to *[fdxf@aha.ru].* Check out the Web site at *[http://www.funcap.narod.ru/index.html].*

MAY 4–6

AQUINAH, MA The Fall River ARC will operate W1ACT/P from the Gay Head Lighthouse, May 4, 18:00 UTC–May 6, 19:00 UTC. IOTA NA046. QSL via *Roland Daignault, Jr., N1JOY, 19 Davis Rd., Westport MA 02790, SASE only.* Frequencies: 14.260, 21.260, 28.460, 50.130.

MAY 5–6

CONNECTICUT QSO PARTY The Candlewood ARA will sponsor the Connecticut QSO Party 2000Z May 5th–2000Z May 6th, with a rest period 0400Z–1200Z. Modes: Phone, RTTY and CW. Work stations once per band and mode, mobiles as they cross county lines. No repeater QSOs. Single operator, fixed/mobile, Novice, QRP(5W), Multi-single Multi-multi classes plus Connecticut club competition. Connecticut stations may contact other Connecticut stations for QSO/multiplier credit. Connecticut stations exchange report and county; others exchange report and state/province/DXCC country. Non-CT stations work CT stations only. Frequencies: CW — 40 kHz up from lower band edges; Novices 25 kHz up from low end. Phone — 1.860, 3.915, 7.280, 14.280, 21.380, and 28.380. VHF — 50.150, 144.200, and 146.580. RTTY/PSK31/Digital — normal RTTY bands. All bands (HF, VHF, UHF) except WARC bands count. Score one point per phone QSO and two points per CW or RTTY/Digital QSO. QSOs with club station W1QI, and ARRL HQ station W1AW count 5 points. Connecticut stations multiply QSO points by states/provinces/Connecticut counties worked (DX only one multiplier); others multiply by Connecticut counties worked (work CT stations only). Plaques and certificates (100 point minimum). Special certificate for working all 8 Connecticut counties. Send entry and SASE for results by June 6th to *CARA, P.O. Box 441, Danbury CT 06813-3441 USA.*

MAY 16–26

ONTARIO, CA A "Run for The Wall" event volunteer will operate N7LFK 1600Z May 16th–0700Z May 26th, mobile across the heartland of the USA during the 13th annual pilgrimage to Washington DC. Phone 14.265, 21.365, and 28.465. For a certificate, send QSL to *RFTW (Mike Paxton) P.O. Box 2625, Gearhart OR 97138-2625 USA.* This event is to help create a groundswell of support for all American prisoners of war and missing in action (from all wars). This event brings together fellow veterans to promote physical and emotional healing from the results of being injured by war and its consequences. All military veterans who were radio operators, are urged to operate N7LFK, giving their old military call signs, their duties, and locations they operated from. This mobile special event will close at the National Vietnam Memorial (The Wall) in Washington DC on May 26th. For further info contact *N7LFK, Mike Paxton, at (503) 738-7853, or visit [www.rftw.org].*

HAMSATS

Amateur Radio Via Satellites

Andrew C. MacAllister W5ACM
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AO-40 at Home

The proliferation of commercial S-band downconverters, originally for multichannel cableless pay TV, that have been successfully pressed into service for AO-40 (AMSAT-OSCAR-40) Mode "S" reception has been fast and exciting.

While most of these units can be used "as is," they typically convert the 13-cm signals from AO-40 on 2401.323 MHz to non-ham frequencies in the vicinity of 122 MHz. This is usually outside the optimum range of the converters, thus providing low gain and poor noise factors.

The most common commercial unit that has been used successfully is the Drake 2880. Hundreds, if not thousands of these devices have been plucked from the shelves of surplus distributors here and in Japan. With a relatively simple modification, 2400 MHz can be converted to 144 MHz by simply changing the main oscillator crystal. The 2880 then becomes a great asset for terrestrial and S-band hamsat reception. Other changes to move the IF (Intermediate Frequency) filter center down to the two-meter ham band, and tune the input filter with very slight lengthening of three internal striplines to favor 2400 MHz, provide useful gain and noise figure enhancements.

For the price of a new crystal ($12 to $14), and the surplus downconverter ($25-$45), the result is a cost-effective station addition that can hear the beacons from AO-40, AO-16 (AMSAT-OSCAR-16), and UO-11 (UoSAT-OSCAR-11). As mentioned in the March "Hamsats" column, a good place to start for S-band converter and antenna information is Jerry K5OE's Web page [http://members.aol.com/k5oe/drake.htm].

Antennas that will do well in conjunction with these downconverters are easy to get. Due to the wide range of channels in use for various MDS (Multipoint Distribution Service) TV setups, most antennas will work from 2100 to above 2600 MHz. They range in price from $40 to $75, depending on source, type, and quantity purchased.

I recently did some simple qualitative tests in the back yard using three Drake 2880s and a Swedish-made Parabolic AB [http://www.parabolic.se] "AMSAT Mode S Converter." The commercially-built amateur-radio converter ($220 shipped via air) became my comparison standard. It is advertised as a weather-proof downconverter with an input range of 2400 to 2404 MHz, output from 144 to 148 MHz, a maximum noise figure of 1.0 dB, a gain figure of 30 dB, and power supply requirement of 11.5 to 15.5 VDC at 300 mA. DC power is sent back through the coax to the antenna-mounted converter. The unit comes with mounting brackets, but the bias tee is sold separately. Most hams make their own or find one for a MDS converter that can supply the right voltage and current.

After completing the easier modifications to the three Drakes, two were mounted to large (higher-gain) MDS antennas in the back yard. The Swedish Parabolic converter was connected to a smaller antenna with about half the surface area of the others. All three antennas were bolted to a single cross boom above a tripod. A small 2400.600 MHz signal source that had been used for S-band receiver experiments during the early days of AMSAT-OSCAR-13 was activated in the house. About an hour prior to a good UO-11 pass (2401.500 MHz carrier), the Drakes were calibrated to match the frequency conversion specifications of the Swedish unit. While the Drakes exhibited a lot more frequency drift on power-up than was hoped, they at least seemed to be working.

***Photo A.** Comparing Drake 2880s, a Parabolic AB "AMSAT Mode S Converter," and three antennas in the back yard.*

***Photo B.** Close-up view of the Parabolic downconverter on the small center antenna.*

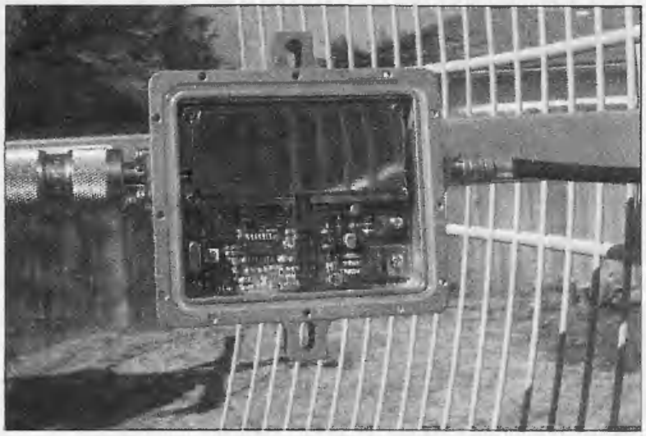

Photo C. Close-up of an open Drake 2880 ready for tuning. The crystal and tuning capacitor are in the lower left.

Photo D. The AMSAT-NA Board of Directors met in Orlando, Florida, in February to define new projects and direction.

When it was time for UO-11 to arrive at the horizon, there were a few surprises. First, the downconverters were all working, but — second — it was extremely difficult to keep up with the Doppler shift during the course of the pass (about 100 kHz in 10 minutes), and the antenna pointing efforts due to the relatively narrow beamwidth of the antennas, the relative speed of the satellite across the sky, and the lack of rotators in this simple test setup.

A single VHF receiver was used with all of the downconverters via a coax switch. The S-meter readings were slightly lower on the Drakes compared to the Swedish Parabolic unit. Since the Parabolic used an antenna with at least 3 dB less gain, the Drakes were calculated to be at least 4 to 5 dB less sensitive. This deficiency was notable, but not a problem when the strong signal from AO-40's S-band beacon was later monitored.

February 2001 AMSAT board meeting

On the morning of Saturday, February 24, 2001, an AMSAT-NA Board of Directors meeting was convened in Orlando, Florida. The purpose was to begin the process of defining projects and direction for the future. Attendees included Jan King W3GEY, Harwood "Shep" Shepherd AA7MH, Dick Daniels W4PUJ, Dick Jansson WD4FAB, Keith Baker KB1SF, Lyle Johnson KK7P, Barry Baines WD4ASW, Bruce Paige KK5DO, Bill Tynan W3XO, Tom Clark W3IWI, Lou McFadin W5DID, Ray Soifer W2RS, Robin Haighton VE3FRH, B'dale Garbee KBØG, Phil Karn KA9Q, and your reporter.

The first order of business was a presentation by Keith Baker on the findings of the AMSAT-NA Strategic Planning Committee at their recent meeting in Washington, DC.

During the weekend of February 17, 2001, the AMSAT-NA Strategic Planning Committee met to formalize their findings over the previous two years. The vision of the committee encompasses the premise that AMSAT is a vibrant, solid organization providing continuous worldwide amateur radio satellite service. The four goals defined by the group were:

1. AMSAT-NA will develop utilities and related equipment for continuous amateur radio communications.
2. AMSAT-NA will provide opportunities for members to participate and contribute on many levels.
3. AMSAT-NA will be the primary resource for amateur satellite information, training, and education.
4. AMSAT-NA will acquire sufficient resources to support the organization's vision.

Following the presentation and ensuing discussion about the strategic planning efforts, the activity continued with three project summaries promoting options for the next AMSAT-NA satellite. The choices go beyond digital versus analog. There are orbital options, launch opportunities, power systems, and frequency considerations.

Longtime AMSAT supporter and previous member of the AMSAT Board of Directors Phil Karn KA9Q discussed his ideas for a digital communications system that could be used in a number of environments.

Continued on page 59

Photo E. Jan King W3GEY and Phil Karn KA9Q compare notes at the AMSAT-NA BoD meeting.

Photo F. Bill Tynan W3XO, Barry Baines WD4ASW, Lou McFadin W5DID, and Robin Haighton VE3FRH during a visit to the AMSAT-NA lab in Orlando, Florida.

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Meet SSTV-PAL and MMSSTV

Here are two new freebies for your ham software collection. And if you have a yen for quality SSTV at a rock-bottom investment (I repeat, FREE), this is what you are looking for.

If you have been reading this column during the past few years, you have seen my enthusiasm for sending and receiving color pictures (slow scan TV) over the HF bands. There are a number of modern pieces of software that do this very well these days. Most of them have a price tag and, due to a lot of refinement, are well worth the cost.

This month, I will introduce you to free software that will perform these tasks very well and, if you already have a soundcard hookup for digital modes, the cash outlay to get on SSTV will be, as I stated in the beginning, zero. There is, at this writing, a learning curve. At the rate the programmers are upgrading this software, you will probably find that the learning part will be reduced to a level you can deal with by the time you read this.

For your edification, this article is usually written two to three months prior to delivery to your doorstep. A lot transpires in that period of time. Further, that is why, from time to time, some of the URLs in The Chart may be out of date when you try them. If I weren't so lazy, I would put up a Web site with current changes to that Chart. But then, I get to communicate with you more this way, which is fun in itself. Perhaps — Laziness breeds familiarity?

Back to this new software I just got up and running. The beta version of MMSSTV is fairly early in the development stages, but, even at version .08 (oops, been a few days — now version 0.11), it works well. I downloaded my first copy, had it installed, and was nosing around in it in minutes. Very simple, straightforward installation and setup.

You may already be aware of Mako Mori's MMTTY program, which has taken the RTTY folk by storm. It is a soundcard RTTY program that has won a lot of enthusiasm in the ham community. You will find it listed for download on the new URL listed in The Chart where all the JE3HHT software including MMSSTV and information can be found.

Incidentally, both the SSTV programs I mention today have simple installation of updates. Simply download and unzip them; then place the files in the subdirectory where the old version resides. The data and images specific to your station remain intact.

Before the version .08, MMSSTV did not accept the popular .jpg format, but by the time I was really ready to rock and roll, this small problem had been addressed. The .jpg format is not nearly the space hog that some of the other formats are. I have software that will convert from one format to another, but

Fig. 1. Screenshot 1. This is the editing program, SSTV-PAL, from Erik VK7AAB. The image in the central pane is an older image I imported. I then went through the copy and paste sequence (see text) so you could see that it made its way from one program to the other. Be sure to download the Help File and open it separately (see text). You will find how to make headers and footers and insert text and graphics into your main image. One of the biggest helps is to have the "tool tips" turned on. When you point to a button, you will see a balloon describing the function of the button. The "Load Pic" button opens a file window allowing you to navigate to any subdirectory and image in your system. The program works with the most popular graphics formats and has pop-up windows so you can choose formats and other options as you work. There are several "undo" commands which we find convenient. Make an error and immediately go back to where you were. This freeware program is designed specifically to do the things a ham wants to do to his images. And it does them more easily and quickly than the high-buck professional graphics programs available.

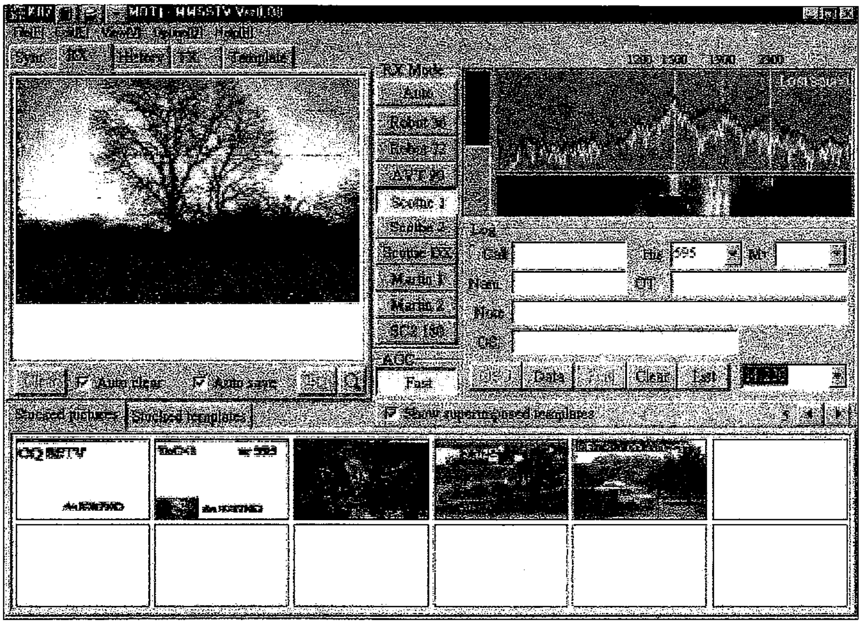

Fig. 2. Screenshot 2. This is the new MMSSTV program by Makoto Mori JE3HHT. I took this shot of a received image before it was finished so that you could see the DSP filter in action on the spectral display. The display will show much wider bandwidth when the QSO returns to SSB vocal reception according to the filter setting in your rig. This version .08 is the first that provided for JPEG format. The thumbnails at the bottom of the panel can be clicked on and dragged to the transmit pane and vice versa. This helps at this time to facilitate file handling (see text). In the thumbnail to the right, you will see the image pasted from the SSTV-PAL program (see text for procedure). There is also a History file of received images which you can access by clicking the History tab above the main image panel. When in this mode, you will have a set of arrows at the bottom of that pane so you can click back through any or all of the previously received images. The History subdirectory is found in the MMSSTV directory, so it is possible to manipulate these files however you please. This program was popular within just a few days after the first beta release, and is surely going to help focus new attention on another great ham mode.

really didn't want to load up my drive with a lot of .bmp (bitmap) files, so the additional format was welcome.

The next area to address was the still limited ability of the program to add little extras to the images such as callsigns or text messages. Perhaps these features were somewhere waiting in the wings but the Help File was hiding them. Further, my graphics software package ran into a snag right away when I went to insert a caption in one of my first images.

This was no fault of the graphics program, but did put a crimp in progress. This next magic piece of software came to the rescue and handled the minor edits with ease. I like things that work.

More freeware to the rescue. A short time ago, I became aware of a program that is designed to take care of this problem, and it does it very well. It is SSTV-PAL, written by Erik VK7AAB and available for download at the URL listed in The Chart. And, while you are there, you will see also listed his PSK-PAL, which I haven't had much of a chance to use as yet. Perhaps, next month.

At the time of this writing, SSTV-PAL is highly effective in adding effects and "ham-preferred" changes to images on the fly for the other popular SSTV software such as ChromaPIX. I will assume that by the time you read this, SSTV-PAL will be much more cooperative with MMSSTV users. [See sidebar. — ed.]

I found the only thing necessary to get these two programs to work together was to study the file structure in MMSSTV. That is, if you will look in your MMSSTV directory, there is a "stock" file setup as soon as you install the program. It will have a few templates available that you can open in SSTV-PAL by clicking the "Load pic" button, manipulating the windows file directory that appears to the right of the button to the "stock" subdirectory, and selecting the file you wish to edit. A double click should bring it in.

Then you will want to learn all the magic available, or at least a portion of the magic, do the necessary edits, and, when you are finished, save it back to the file directory where you keep your images for MMSSTV.

For editing, you will find a lot of help from the balloons that pop up when your cursor points to a button. The "tool tips ON" option makes sure this happens. You will also find a lot of info in the Help File. I found the Help button would not address this file, so, while the program was running, I double clicked on the Help File in the subdirectory and it came up nicely in Windows Help format. The author feels that once you are used to using the program, you won't need this excess baggage anyway, so he purposely did not integrate it.

Saving requires a study in file manipulation. This is easier than it looks, but there is not, at this writing, a built-in push-button to accomplish this automatically. MMSSTV is new and SSTV-PAL has those automatic setups for programs like ChromaPIX, W95SSTV, JVcomm, and several other popular programs.

At this time it was necessary to devise a simple work-around to move the finished work where I wanted it. If you will look in the upper left corner of the SSTV-PAL panel, you will see a "Copy" button. That, you will find, will copy the image in the large editing pane to the Windows clipboard. That is the handy, yet invisible, feature in Windows 95™ that allows us to use the copy and paste commands.

I think there is a little more visibility of this file in the newer versions of Windows. I do have a computer with Windows98™ and I need to study that system a bit more. Even the simple transition to Win98 caused me a few anxious moments as I lost my self-defined logic path to the files. Back to the story.

Then go to the MMSSTV panel, which you should have running in the background, and click on the transmit tab, and, just for good measure, also click on the transmit image pane. Then hit Control V (to paste) and your edited image from SSTV-PAL will magically appear. From there, you click and drag it down to the row of thumbnails at the bottom of the MMSSTV panel. If you check the "stock" subdirectory before and after this cart-and-pony performance, you will be pleased to see that you have added an image to the list.

From there you can manipulate the file however you wish. There is room in the MMSSTV stock image thumbnail display for over 200 images for instant recall, so you can edit your favorites and have them at the ready when you are on the air.

It took a little cut-and-try to discover this method of file transfer, but you can always

say you saw it here first. And ... hopefully ... very soon, the SSTV-PAL will have an automated setup for the MMSSTV. Until then, this is one way to get the job done.

Now you are ready to start having fun with the pictures over the air. This MMSSTV is evolving so quickly, it seems phenomenal. In the process of daily living, I have missed the last two updates, but I will tell the great things I have noticed to this point in time.

There are numerous modes you can use when operating SSTV. Commonly, stateside, we use what is referred to as Scottie 1. Just by listening, most of us have no clue what is coming at us, so the MMSSTV, since it is written to be used anywhere in the world and commonly used modes vary from country to country, will automatically determine the received mode and make the necessary switch for you.

For example, I was monitoring received signals one of the first evenings I had the program installed and it was fascinating to watch three images follow one another in three different modes and watch the mode buttons light up during the automatic switching process in the order that was necessary.

This automation isn't supposed to be entirely dependable under marginal conditions, but I saw an European image with a considerable amount of noise lines, and it worked just like it was supposed to for that one. It is always good practice to announce the mode you are going to transmit in, by voice, before sending your image, and you can see the reason why when poor conditions prevail.

MMSSTV also has its own minilog and it works very well. Simple entry and save. And the important feature to me is that it will export in ADIF format so that I can import it into the logging program. It is necessary to have all the communications programs have their activities coordinated in one piece of software, so this was a nice feature to find.

Just a little afterthought: When you are downloading these programs, download all the Help File type information you can find. At this time, the SSTV-PAL has a very nice Help File but does not seem to address it from the Help button. But if you go directly to the file and double click on it, the windows format Help feature will run, and there is good information for you to use.

MMSSTV has a lot of information ready for download, but it is too early for a Help File to come forth. One of the bits of information you will find is that the author recommends a fairly fast processor and plenty of RAM. I am using 120 MHz CPU with 32 Mb RAM, and when I get these programs running along with the other "necessities," the machine tends to slow down and issue various warnings, but it keeps on plugging. And the operation has been a success despite what is termed "limited resources" by the programming crowd.

A few little tidbits. You will notice there has been a transition of the eGroup's reflectors to the Yahoo site. There are the same discussion groups as well as a file section. I have not included any advisory for download from Yahoo. I went there and had to sign up before gaining access to the purported Files section and never found the digital files for downloading. I heard other such complaints. It is complex and requires a certain amount of luck.

The bad part is that the spam to my mailbox increased exponentially all of a sudden and I am getting all these ridiculous sales pitches that I cannot put a stop to. The "Remove" addresses do not exist when you send Remove mail to them. The damage is done, but I am finding download sites to list in The Chart that are elsewhere, so perhaps you may be spared the spam. This problem will hopefully abate soon as the Groups move

Instant Update

Just one day after this article was in the mail to *73*, I received the update that makes it a one-button image transfer from SSTV-PAL to MMSSTV. The workaround described in the article will work in the event you have technical difficulties. Erik made the fix with the following file: [SstvPalUpdate23FEB20001.zip], which you can download from his site. [Yes, that's an extra zero in 2001. — ed.]

Unzip this or perhaps by the time you read this a later update, and place the file in your SSTV-PAL directory. You will then have the option (a button will display in the upper left corner) to "send to MMSSTV" as soon as you follow the directions so that SSTV-PAL can find MMSSTV. Both programs must be running for the Send function to work.

Enjoy!

Source for:	Web address (URL):
Mix W Soundcard program for PSK31, RTTY, new modes, MTTY, FSK31, more	http://tav.kiev.ua/~nick/my_ham_soft.htm http://users.nais.com/~jaffejim/mixwpage.htm
MMHam site — MMTTY — MMSSTV	www.geocities.com/mmhamsoft/
VK7AAB — SSTV-PAL — PSK-PAL	http://users.origin.net.au/~crac/
TrueTTY — Sound card RTTY w/ PSK31	www.dxsoft.com/mitrtty.htm
Pasokon SSTV programs & hardware	www.ultranet.com/~sstv/lite.html
PSK31 — Free — and much PSK info	http://aintel.bi.ehu.es/psk31.html
Interface for digital - rigs to computers	www.westmountainradio.com/RIGblaster.htm
Soundcard interface info — includes Alinco	www.packetradio.com/psk31.htm
Interface info for DIY digital hams	www.qsl.net/wm2u/interface.html
WinWarbler info and free download	www.qsl.net/winwarbler/
MFSK-related tech info — how it works	www.qsl.net/zl1bpu/
Throb — New — lots of info	www.lsear.freeserve.co.uk/ www.btinternet.com/~g3vfp/
Download Logger, also Zakanaka	www.geocities.com/kc4elo/
PSKGNR — Front end for PSK31	www.al-williams.com/wd5gnr/pskgnr.htm
Digipan — PSK31 — easy to use — new v. 1.6	http://members.home.com/hteller/digipan/
TAPR — Lots of info	www.tapr.org
TNC to radio wiring help	http://freeweb.pdq.net/medcalf/ztx/
ChromaPIX and ChromaSound DSP software	www.siliconpixels.com
Timewave DSP & AEA (prev.) products	www.timewave.com
Auto tuner and other kits	www.ldgelectronics.com
XPWare — TNC software wilh sample DL	www.goodnet.com/~gjohnson/
RCKRtty Windows program with free DL	http://www.rckrtty.de/
HF serial modem plans & RTTY & Pactor	http://home.att.net/~k7szl/
SV2AGW free Win95 programs	www.raag.org/index1.htm
Source for BayPac BP-2M & APRS	www.tigertronics.com/
Int'l Visual Communication Assn. — nonprofit org. dedicated to SSTV	www.mindspring.com/~sstv/
Hellschreiber & MT63 & MFSK16 (Stream)	http://iz8bly.sysonline.it
HamScope — multimode w/ MFSK16	http://users.mesatop.com/~ghansen/
YPLog shareware log — rig control — free demo	www.nucleus.com/~field/

Table 1. The Infamous Chart ... updated monthly.

to another site. I will watch and see. I may be forced to change my E-mail address that I have had for many years due to the annoying spam that has no end in sight.

I understand from other hams that there are filters available when you use the Microsoft mail software to eliminate some of the spam, but then you find the really clever programmers who have no life and write viruses which attack the Microsoft mail program directly and leave some of these others alone. Choices to make.

QRP PSK is going to be around a long time. There are hams running low power to avoid RFI and there are others who have found there are very few big guns to cause them QRM. Additionally, there are those QRP purists whom I have to admire.

I have had the pleasure of working a number of QRP stations, and the other day, a simple lesson was taught. The other ham was running 10 watts to my 50 and he was on the east coast, let's say 2,000 miles away. The path was marginal with fair copy. He suggested going to QPSK and reducing power. Soon we were both running 5 watts with decent antennas and perfect copy for the rest of a pleasant rag chew session.

A lesson well learned. If QRP operators can coordinate their efforts, the print on the monitor can be a lot more enjoyable. Just a little thought to pass around. Could make life easier and hamming more productive.

That's about it for this month. If you have questions or comments about this column, E-mail me [jheller@sierra.net]. I will gladly share what I know or find a resource for you. For now, 73, Jack KB7NO.

Modular Remote Coax Switch

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I would be happy to answer any reasonable question you might have, if an SASE is enclosed.

We now have excellent-looking FR4 silk-screened and drilled PC boards, five of them in a set, for $23.00 plus $1.50 S/H per set for those who prefer to build the units in this manner. Order from FAR Circuits, 18 N 640 Field Court, Dundee IL 60118. For additional ordering information, check the FAR Circuits Web site at [www.cl.ais.net/farcir/]. 73, Carl Markle K8IHQ.

"How High's the Water, Mama?"

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trends with rainfall amounts within a known flood area during heavy rainfall. The beauty of using packet radio for this is the "real time" information provided. The raw data may be imported into a spreadsheet to historically correlate this and other outside data.

I wish to stress that *teamwork* was the key to the successful implementation of this project, as was the generous assistance of the parties involved in my preparation of this article.

Bookbind THIS! — Conclusion

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the new volume for the first time to prevent damage to the bound stem and cover. The procedure that I've found suitable is as follows:

• Place the volume on a table so that it is flat.

• Using a thumbnail, run a crease along the cover adjacent to and parallel with the stem at about 1/8 inch from the stem.

• Open the cover carefully and allow it to fold along the crease.

• To prevent damage to the bound stem, the volume should not be opened up to a completely "flat" position.

Although the number of steps in the process appear to be many, they are provided for clarity. The actual steps involved are simple and easily performed with minimum tools and material.

Now that the bookbinding process is complete, sit back and think about the amount of technical information that has been saved for future use. In addition, think about all of the valuable shelf space that has been retained. If in doubt about the space savings achieved, implement the process and gauge the results. You will be pleasantly surprised!

Preventive Brain Surgery for Icom Xcvrs

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Now and in the future

Performing this procedure has put my mind at ease. Now I'm not worried about my rig going blank at some future date. To remind me that the battery was changed, and so I'll know when it will need a fresh one, on the rear of the rig I placed a small sticker with the date the lithium cell was changed, and when a new one is due in five years. Plus, in five years, it will be a snap to change the new battery.

All I'll have to do is remove the covers, power the Icom up, and remove and replace the CR2032 lithium battery. No soldering will be needed! This modification should add several more years of life to your radios, and you'll have the satisfaction of being able to keep them running indefinitely!

HAMSATS

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Using TDMA (Time Division Multiple Access) encoding, simple design parameters, limited bandwidth, and low power in the satellite hardware, Phil's concept would provide a 21st-century microsat-style hamsat. Several channels of data, digital communications, and digital voice would be simultaneously supported. His proposal goes one step further to include inexpensive ground system gear, to be developed parallel to the satellite hardware portion of the project.

Previous AMSAT Vice President of Engineering Dick Jansson WD4FAB has defined his version of the next Phase 3 (high orbit and long life) satellite. In an effort to adhere to the KISS principle to "keep it simple," Dick's satellite would have features similar to AMSAT-OSCAR-40's, but would not have any internal rocket motors, would be spin-stabilized, cost much less than AO-40, use frequencies between 70 and 13 cm, fit on an Ariane 5 ASAP (Ariane Structure for Auxiliary Payloads) ring for a flight to GTO (Geostationary Transfer Orbit), and require only two to three years to complete. It's still an ambitious project, but would incorporate a lot of technologies that have been used before.

Lyle Johnson KK7P was actively involved with AO-40 digital systems and projects at TAPR (Tucson Amateur Packet Radio). Lyle's satellite proposal had many similar characteristics with that of WD4FAB, but differed on the antenna configuration and basic spaceframe shape. While WD4FAB's system called for patch antennas on the surface facing the earth and short whip antennas on the back side for perigee (lowest part of the orbit) operation, KK7P's configuration calls for collinear antennas extending from the top and bottom of a spinning satellite that would be positioned so the plane of the antennas would be perpendicular to the earth when at apogee (highest point of the orbit).

Due to the nature of the GTO provided by an Ariane 5 (about 650 km perigee, 40,000 km apogee, and 7-degree inclination to the equator), satellite configuration is an issue. WD4FAB's design favors a shape that looks like a suitcase with tapered ends. All sides are covered with solar cells, with the exception of the side with the patch antennas that faces the earth. KK7P's design is a more cylindrical shape, with solar cells around the sides.

Lyle KK7P also proposed a new version of the IHU (Internal Housekeeping Unit) computer that has been used on previous Phase 3 satellites. His rendition would use only a few integrated circuits to achieve the same capability that has required much larger circuit boards in the past. It would also run on about a tenth of a watt.

During the second day of the Board of Directors meeting, AMSAT President Robin Haighton VE3FRH provided a synopsis of the proposals along with brief comments on the state of the organization. AMSAT-NA is currently in excellent shape. Although it is true that the Phase 3D (AO-40) project has caused significant financial stress, the organizational enthusiasm is high and there are some fine new projects on the horizon.

The Board views the GTO as the best orbit for the next large AMSAT satellite, and LEO (Low Earth Orbit) as the perfect testing ground for new digital technologies, like those proposed by KA9Q. A study was requested to pick the best points of the two

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More Good than Bad

Atmospheric noise will severely limit activity on the upper bands, and daytime ionization will substantially weaken the lower ones as May progresses and summer arrives.

Because of these seasonal influences, the bulk of your foreign contacts are likely to be in the 17- to 30-meter range, but unusually erratic solar behavior could cause conditions on all bands to range from very good (VG) to very poor (VP) this month.

The best period, as shown on the calendar, is likely to last from the 2nd through 8th and should provide the most favorable DX conditions that we've seen in quite awhile. There are several other promising periods of shorter duration to watch for, and on average we should experience more good days than bad.

I've pegged the 9th through the 16th as being very unfavorable, but hang in there because conditions are likely to fluctuate widely throughout the period. I'm forecasting the sun to be particularly restless around the 11th, so expect a geomagnetic storm to develop by the 13th if a large flare or CME is launched in our direction.

Band-by-band summary

10 and 12 meters

Daytime absorption will increase, causing seasonally weak signals as summer approaches. Follow the sun as usual and work to the east in the morning and west during the afternoon. Look for a mid-afternoon peak on 15 meters, especially to the southern hemisphere. Short-skip will be between 1,000 and 2,000 miles.

15 and 17 meters

These bands will also weaken with the approach of summer, but should hold up fairly well throughout May. Signals will typically peak toward the east in the mid-morning hours. Latin America and South America will be best on either side of local noon and into

May 2001						
SUN	MON	TUE	WED	THU	FRI	SAT
		1 F	2 F-G	3 G	4 F-G	5 G
6 G	7 VG	8 VG	9 F-P	10 F-P	11 F-P	12 P
13 VP	14 P	15 P	16 F	17 F-G	18 F-G	19 G
20 F-P	21 F	22 F-G	23 G	24 G	25 F-P	26 F
27 F-G	28 G	29 G	30 G	31 F-G		

EASTERN UNITED STATES TO:												
GMT	00	02	04	06	08	10	12	14	16	18	20	22
Central America	15-20	(15) 30	20 (40)	(20-40)	x	(20)	20	(20)	(15)	(15)	15 (20)	(10) 17
South America	15 (20)	(15) 20	20 (40)	(20-40)	(20)	x	(15)	(15)	x	(10)	(10-20)	(10) 20
Western Europe	20	20	(20-40)	(40)	x	(20)	x	x	x	x	(20)	20
South Africa	x	(40)	x	(20)	x	x	x	x	(15)	(15)	x	x
Eastern Europe	20	20 (40)	(20)	x	x	x	(20)	x	x	(15)	(15)	(20)
Middle East	20	20 (40)	(20)	x	x	x	x	x	x	x	(20)	(15)
India/ Pakistan	(15-20)	(20)	x	x	(20)	x	x	x	x	x	x	x
Far East/ Japan	(15)	x	x	x	x	x	(20)	(15-20)	(15)	x	x	(15)
Southeast Asia	(15-20)	x	x	(20)	x	x	(20)	x	x	(15)	x	x
Australia	(15)	(15)	x	x	(20-30)	(20-30)	(20)	(20)	x	x	x	x
Alaska	(15-20)	(15-20)	(15-20)	20	20 (40)	(20-40)	(20)	(20)	x	x	(15)	(15-20)
Hawaii	(15-20)	(15-20)	(15-20)	20	20 (40)	(20-40)	(20)	(20)	x	x	x	(15)
Western USA	(10) 30	(10) 30	(10) 40	(15) 40	(20) 40	(20-40)	(15) 20	(10) 20	(10-20)	(10-20)	(10-20)	(10) 20
CENTRAL UNITED STATES TO:												
Central America	(10) 20	(15) 30	20 (40)	20 (40)	(20-40)	(20)	(20)	(15) 20	(15-20)	(10-20)	(10-20)	(10) 17
South America	10 (20)	(10) 20	(15) 30	(15) 30	(20-40)	(20)	(20)	(15)	(15)	(10)	(10-15)	(10-20)
Western Europe	(15) 20	20	(20-40)	(20-40)	x	(20)	(20)	x	x	x	x	(15-20)
South Africa	x	x	(40)	(20-40)	(20)	x	x	x	(10-15)	(10-20)	(20)	x
Eastern Europe	(20)	(20)	(20)	(20)	x	x	(20)	(20)	x	(15)	(15-20)	(15-20)
Middle East	(15-20)	(20)	(20)	(20)	x	x	x	x	x	x	(20)	(20)
India/ Pakistan	(15-20)	(15-20)	(20)	x	x	x	(20)	x	x	x	x	x
Far East/ Japan	x	(15)	(15)	x	x	(20-40)	(20)	20	(20)	x	x	x
Southeast Asia	(15)	(15)	(15-20)	(20)	x	x	(20)	(20)	(15-20)	(15)	(15)	x
Australia	(15)	(15)	(15)	(20)	20 (40)	(20-40)	(20-40)	20	(20)	x	(15)	x
Alaska	(10) 30	(10) 30	(10) 40	(15) 40	(20) 40	(20) 40	(20-40)	(15-40)	(10) 30	(10-20)	(10-20)	(10) 20
Hawaii	(15-20)	15 (20)	(15-20)	20	20	(20)	20	(20)	x	x	x	(15)
WESTERN UNITED STATES TO:												
Central America	(10) 17	(15) 20	(15) 20	20	(20)	(20)	(20)	(20)	(20)	(10-20)	(10-15)	(15-20)
South America	(10-20)	(10) 17	15-20	(15) 20	(20)	(20)	(20)	(15)	(15)	x	(15)	(10-15)
Western Europe	(15-20)	(20)	20	(20)	x	x	x	(20)	(15)	(15)	(20)	(15-20)
South Africa	x	x	x	(20)	(20)	x	x	(20)	(20)	(15)	x	x
Eastern Europe	(15-20)	(20)	(20)	(20)	x	x	x	(20)	x	x	x	(15-20)
Middle East	(20)	(15-20)	(15-20)	(20)	x	x	x	x	x	x	x	(20)
India/ Pakistan	x	x	(15)	x	x	x	x	(20)	x	(15)	x	x
Far East/ Japan	(15)	(15)	(20)	(20)	(20)	(20-40)	(20-40)	(20)	(20)	(15-20)	x	(15)
Southeast Asia	x	x	(15)	(15)	x	(20)	(20)	(20)	(15-20)	(15-20)	(15)	x
Australia	(10-15)	(10-15)	15	(15-20)	20	20	20	(20)	20	(20)	x	(15)
Alaska	(10) 40	(10) 40	(10) 40	(15) 40	(20) 40	(20) 40	(20-40)	20-40	(15) 40	(10) 40	(10) 40	(10) 40
Hawaii	(10-15)	(10-20)	(10-20)	(15-20)	20	20	(20-40)	20 (40)	(20-40)	x	x	(10-15)
Eastern USA	(10) 30	(10) 30	(10) 40	(15) 40	(20) 40	(20) 40	(20-40)	(15-20)	(10) 20	(10-20)	(10-20)	(10) 20

Table 1. *Band, time, country chart. Plain numerals indicate bands which should be workable on Fair to Good (F-G) and Good (G) days. Numbers in parentheses indicate bands usually workable on Good (G) days only. Dual numbers indicate that the intervening bands should also be usable. When one number appears in parentheses, that end of the range will probably be open on Good (G) days only.*

the early evening. Work westward from late afternoon through mid-evening and pay particular attention to long paths across the equator, especially on 17 meters. Short-skip will average between 1,000 miles and 2,000 miles.

20 meters

Around-the-clock communications will be possible to most areas of the world when HF conditions are good. The strongest peaks will occur right after sunrise and just before sunset, but late afternoon peaks often occur as well, especially to the southeast. In the evening, try working over the pole as well as toward the western and southern Pacific. Short-skip will be between 500 and 2,000 miles during the day and from 1,000 to 2,000 miles at night.

30 and 40 meters

These bands could be your best choices from sunset until sunrise on good (G) days, but increasing thunderstorm activity will often limit opportunities. Atmospheric noise is typically higher on paths across the tropics but the best openings are still most likely to be found in the southern hemisphere. Don't overlook daytime openings, but skip will be limited to about 750 miles. At night, expect skip to vary from 500 to over 2,000 miles.

80 and 160 meters

High static and weak signals will prevail but a few openings will still be available between sunset to sunrise on the good (G) days shown on the calendar. Peaks will usually occur near midnight and again in the pre-dawn hours, but won't happen regularly. Expect short-skip to vary from 1,000 to 2,000 miles. 73

HAMSATS

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GTO designs proposed by WD4FAB and KK7P Funding was allocated for the new IHU design by KK7P, which would be useful for multiple platforms.

Additionally, the Board voted to begin work on KA9Q's multichannel, amateur-radio version of a TDMA satellite and the necessary ground systems, which would be out to potential users even at the Beta-test (pre-launch) stage. The final satellite hardware could possibly be used on the space station, a GTO satellite, or be attached to almost any other primary satellite as a passenger.

In addition to these efforts directly from AMSAT-NA, there are other groups working with support or input from AMSAT-NA on shorter-term satellite programs. Will the next hamsats be from university programs, ham clubs, or small, dedicated hamsat groups? Watch for new, exciting projects, and even new hardware in space before the end of the year! 73

QRH

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10. Occasionally, for no reason whatsoever, your car would lock you out and refuse to let you in until you simultaneously lift the door handle, turn the key, and grab hold of the radio antenna.

11. GM would require all car buyers to also purchase a deluxe set of Rand McNally (now a GM subsidiary) road maps, even though they neither need them nor want them. Attempting to delete this option would immediately cause the car's performance to diminish by 50% or more. Moreover, GM would become a target for investigation by the Justice Department.

12. Every time GM introduced a new model, car buyers would have to learn how to drive all over again, because none of the controls would operate in the same manner as the old car."

Thanks to Skip, *newsletter of the Fresno Area Amateur Radio Club, Inc., Dec. '99.*

Crunch This!

Wired News reports that Seti@Home — a project that many hams are deeply involved in — has clocked half-a-million years in computer time searching for ET on home personal computers.

The Seti@Home project harnesses the spare computing cycles of millions of individually owned personal computers worldwide to search for telltale signs of intelligent life in radio signals beamed from outer space.

For the uninitiated, SETI stands for Search for ExtraTerrestrial Intelligence.

Thanks to Newsline, *Bill Pasternak WA6ITF, editor.*

Football Freaks ... er, Freqs

According to Fred Maia's *W5YI Report,* one of the most concentrated RF environments on any given NFL Sunday can be a National Football League stadium. It appears as if everyone from coaches to players to officials to television crews is using wireless devices.

Now, so as to keep the various users of RF gear from bothering one another, the NFL is providing official frequency coordinators at each stadium during the regular season. (And you thought it was hard getting a channel pair for your new repeater!) *Cont.*

No word yet on whether the new XFL, following their coin-toss style of a football scramble, will force spectrum suitors to wrestle for HTs at midfield in order to get first choice of frequency.

Thanks to W5YI, via Newsline, *Bill Pasternak WA6ITF, editor.* 73

NEVER SAY DIE

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Those Root Canals

One of my readers sent along a paper on a new approach to dealing with root canal teeth.

The problem with the normal approach to teeth with root canals is that the millions of tiny tubules that make up our teeth tend to harbor microbes in that warm, wet medium, once the root is dead. These are a source of infection which can seriously affect the immune system and your body.

It's been discovered that when the dead tooth is packed with calcium oxide that this seals off these tubules, preventing microbes from setting up base there. One commercial product is Biocalex.

That beats the heck out of just having to extract the tooth.

Big & Bigger

Considering the way we're being bamboozled at every turn, I'd almost welcome the 97% reduction of the world's population being predicted by several prophets with good past records. It would not only destroy our grossly bloated government, it would break up the conglomerates which have used a weak point in the capitalist system to grow so big that they're able to do just about anything they want.

Big? Three companies, ConAgra, Excel, and IBP supply 81% of our meat! ADM and Cargill have the grain market almost totally tied up. Tyson and Pilgrim's Pride control the poultry market.

Cows and steers these days aren't out grazing in the fields; they're in huge barns being stuffed with grain, water, growth hormones, and antibiotics to fight the sicknesses the growth hormones cause.

Grass? Sunlight? Exercise? You aren't going to have healthy cattle without these. And we don't. But we do get rather tasteless fat-hormone-antibiotic-laden steaks and Big Macs.

Killing off 97% of humanity is a lousy way to get rid of the establishment, and there's no probability that we'll have learned anything from our mistakes, so

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the new establishment could well be even worse. Look at the mess Russia is in as a result of the collapse of Communism.

Slavery Alive and Well

Not here anymore, technically, but it's sure alive and doing a brisk business in Africa. In Mauritania, our State Department estimates there are 90,000 blacks living as the property of Berbers. In Sudan, black women and children go for $90.

In Sudan, the Muslim government militias raid the southern black Christian tribes, killing the men and bringing the women and children north to the slave auctions. Yep, this is going on right now, in 2001.

There's no secret about all this, except for our almost totally silent media. And our black "leaders." Jesse Jackson has remained silent.

Lives Barely Lived

Just as the things that poison our bodies taste so-o-o go-o-o-d, or feel so good, we're spiritually poisoned by activities that feel so-o-o go-o-o-d. Like entertainment. TV, the movies, gambling, most talk radio.

So we get up every morning, go to work all day at some job, go home, have dinner, and watch TV. Have we used the day to learn anything? Not if we can help it. Have we done anything creative? Have we done anything that will help the world progress a little? Har-de-har.

When our lifestyle makes us sick, we go to the doctor. We vote every couple years or so for whoever has the best TV commercials. Or we don't bother.

Have we tried to be really good at anything? Even our jobs? How many books have you read that might help you to do your job better? Read any magazines on the subject? Gone to any lectures, conferences, or workshops?

That's someone else up there on the stage performing. Someone else on TV. Someone else visiting the Pyramids and the Taj Mahal. Someone else up there in a hot air balloon. Someone else on a DXpedition to Navassa Island. Someone else's name on that magazine article or the cover of a book.

Jets have made this huge world easier to see. Libraries and book stores have made learning about anything easier.

God put you here to learn and contribute, not to take a free ride.

Say amen.

Remediation

At California state universities with large black enrollments, close to 90% of the freshmen require remedial classes, mostly in math and English. But, has there been a whimper from the politicians about the fraudulent high school diplomas that have caused this waste of money and time? Last year, the state universities kicked out 6% of the freshmen for failing to master basic math and English skills, even after a year of remedial classes.

I remember when we had a black blues group from Missouri here to record in my studio. When Sherry and I took them out to dinner, we found they were unable to read the restaurant menu. We had to read it to them.

Virtually every black and civil-rights leader is in bed with the National Education Association (NEA), which vigorously fights any effort to improve the system.

Our Founders

Our government today would stun the founders of our country. As James Madison wrote in *The Federalist Papers* (which best explain the intent of the Constitution), except in time of war, the federal government should do 5% and the states 95% of the governing. Today it's more like the other way around.

We were supposed to have a confederation of states, with a minimal federal government to deal with foreign affairs and provide a military for our protection.

Today, between Congress making a mess of everything it does, and a proliferation of federal bureaus, all issuing rules which have the force of laws, we've allowed a monster to gradually be created.

This whole system is so inculcated now that it isn't going to be easy to turn around. Sure, we grouse about the feds taking 60% of our hard-earned money. And we feel totally helpless to do anything about it.

And that's what Congress wants you feel. But, dammit, we are not helpless. We're still allowed a couple minutes every two years to have our say. Our direct say. Alas, virtually all of us throw away those minutes by re-electing the crooks who are stealing and wasting our money.

Is there any way you can (a) make sure that you vote, and (b) never, ever re-elect anyone? Never! Start with the primaries to flush that corrupt Washington toilet. After a couple of elections with no incumbents being re-elected, the crooks...oops, I mean politicians, are going to find it virtually impossible to get all those generous donations from businesses needing influence. This will force thousands of lobbyists to look for more honest work. Like drug smuggling.

That'll be a good start.

Grumble.

We started this nonsense back in 1913, when the federal income tax was established. At that time, only the richest 2% of the people had to pay anything, and the maximum levy was 7%. Now look at the humongous battles over lowering taxes even a smidgen.

Am I exaggerating about Congress making a mess of everything it does? Here's what a recent Cato Institute letter cited:

- Politicians have so mismanaged the Social Security system that it now has a $10 trillion unfunded liability.
- The 40,000-page income tax code now takes a higher percentage of GDP than at any peacetime period in American history.
- Both houses of Congress voted to make it a crime to mention the name of a candidate for federal office in an advertisement within 60 days of an election (only a filibuster kept it from becoming law).
- OSHA made plans to send federal bureaucrats into our homes to check on the "ergonomics" of home office furniture.
- The White House has been giving taxpayer dollars to television networks for inserting messages supporting the War on Drugs into their programs.
- Bypassing Congress, the administration at last count had an astonishing 4,538 business regulations in the process of being implemented by fiat through federal agencies before year-end.

Taxing the Rich

The Democrats' cry that a tax cut is going to favor the rich gets what little is left of my goat. That's pure pandering to the ignorant. They know full well that every time there's a tax cut, the people who are paying the highest taxes are going to benefit more than the people who aren't.

So what?

The rich aren't doing like Scrooge McDuck and wallowing in vaults of money. That would be really stupid, which most rich people aren't, and usually has some connection with their being rich. They know that unless their money is invested in something, that inflation is going to cost them a bundle.

Sure, Bill Gates built a $300 million home, and plans to make it even bigger. But all that money went to hundreds of companies and through them to thousands of workers.

The rest of Bill's billions are invested in Microsoft, and the stock market. When the rich put their money into the stock market, that provides money for the companies

Continued on page 64

Here are some of my books which can change your life (if you'll let 'em). If the idea of being healthy, wealthy and wise interests you, start reading. Yes, you can be all that, but only when you know the secrets which I've spent a lifetime uncovering.

......*Wayne*

The Bioelectrifier Handbook: This explains how to build or buy ($155) a little electrical gadget that can help clean the blood of any virus, microbe, parasite, fungus or yeast. The process was discovered by scientists at the Albert Einstein College of Medicine, quickly patented, and hushed up. It's curing AIDS, hepatitis C, and a bunch of other serious illnesses. The circuit can be built for under $20 from the instructions in the book. $10 (#01)

The Secret Guide to Wisdom: This is a review of around a hundred books that will help you change your life. No, I don't sell these books. They're on a wide range of subjects and will help to make you a very interesting person. Wait'll you see some of the gems you've missed reading. $5 (#02)

The Secret Guide to Wealth: Just as with health, you'll find that you have been brainwashed by "the system" into a pattern of life that will keep you from ever making much money and having the freedom to travel and do what you want. I explain how anyone can get a dream job with no college, no résumé, and even without any experience. I explain how you can get someone to happily pay you to learn what you need to know to start your own business. $5 (#03)

The Secret Guide to Health: Yes, there really is a secret to regaining your health and adding 30 to 60 years of healthy living to your life. The answer is simple, but it means making some difficult lifestyle changes. Will you be skiing the slopes of Aspen with me when you're 90 or doddering around a nursing home? Or pushing up daisies? No, I'm not selling any health products. $5 (#04)

My WWII Submarine Adventures: Yes, I spent from 1943-1945 on a submarine, right in the middle of the war with Japan. We almost got sunk several times, and twice I was in the right place at the right time to save the boat. What's it really like to be depth charged? And what's the daily life aboard a submarine like? How about the Amelia Earhart inside story?If you're near Mobile, please visit the Drum. $5 (#10)

Wayne's Caribbean Adventures: My super budget travel stories – where I visit the hams and scuba dive most of the islands of the Caribbean. You'll love the special Liat fare which let me visit 11 countries in 21 days, diving all but one of the islands, Guadeloupe, where the hams kept me too busy with parties. $5 (#12)

Cold Fusion Overview: This is both a brief history of cold fusion, which I predict will be one of the largest industries in the world in the 21st century, plus a simple explanation of how and why it works. This new field is going to generate a whole new bunch of billionaires, just as the personal computer industry did. $5 (#20)

Cold Fusion Journal: They laughed when I predicted the PC industry growth in 1975. PCs are now the third largest industry in the world. The cold fusion ground floor is still wide open, but then that might mean giving up watching ball games. Sample: $10 (#22).

Julian Schwinger: A Nobel laureate's talk about cold fusion—confirming its validity. $2 (#24)

Improving State Government: Here are 24 ways that state governments can cut expenses enormously, while providing far better service. I explain how any government bureau or department can be gotten to cut it's expenses by at least 50% in three years and do it cooperatively and enthusiastically. I explain how, by applying a new technology, the state can make it possible to provide all needed services without having to levy *any* taxes at all! Read the book, run for your legislature, and let's get busy making this country work like its founders wanted it to. Don't leave this for "someone else" to do. $5 (#30)

Mankind's Extinction Predictions: If any one of the experts who have written books predicting a soon-to-come catastrophe which will virtually wipe most of us out are right, we're in trouble. In this book I explain about the various disaster scenarios, like Nostradamus, who says the poles will soon shift (as they have several times in the past), wiping out 97% of mankind. Okay, so he's made a long string of past lucky guesses. The worst part of these predictions is the accuracy record of some of the experts. Will it be a pole shift, a new ice age, a massive solar flare, a comet or asteroid, a bioterrorist attack? I'm getting ready, how about you? $5 (#31)

Moondoggle: After reading René's book, *NASA Mooned America*, I read everything I could find on our Moon landings. I watched the videos, looked carefully at the photos, read the astronaut's biographies, and talked with some of my readers who worked for NASA. This book cites 25 good reasons I believe the whole Apollo program had to have been faked. $5 (#32)

Classical Music Guide: A list of 100 CDs which will provide you with an outstanding collection of the finest classical music ever written. This is what you need to help you reduce stress. Classical music also raises youngster's IQs, helps plants grow faster, and will make you healthier. Just wait'll you hear some of Gotschalk's fabulous music! $5 (#33)

The Radar Coverup: Is police radar dangerous? Ross Adey K6UI, a world authority, confirms the dangers of radio and magnetic fields. $3 (#34)

Three Gatto Talks: A prize-winning teacher explains what's wrong with American schools and why our kids are not being educated. Why are Swedish youngsters, who start school at 7 years of age, leaving our kids in the dust? Our kids are intentionally being dumbed down by our school system — the least effective and most expensive in the world. $5 (#35)

Aspartame: a.k.a. NutraSweet, the stuff in diet drinks, etc., can cause all kinds of serious health problems. Multiple sclerosis, for one. Read all about it, two pamphlets for a buck. (#38)

One Hour CW: Using this sneaky booklet even *you* can learn the Morse Code in one hour and pass that dumb 5wpm HF entry test. $5 (#40)

Code Tape (T5): This tape will teach you the letters, numbers and punctuation you need to know if you are going on to learn the code at 13 or 20 wpm. $5 (#41)

Code Tape (T13): Once you know the code for the letters (#41) you can go immediately to copying 13 wpm (using my system). This should only take a couple of days. $5 (#42)

Code Tape (T20): Or, you can start right out at 20 wpm and master it in a weekend. $5 (#43)

$1 Million Sales Video: The secret of how you can generate an extra million dollars in sales just by using PR. This will be one of the best investments you or your business will ever make. $40 (#52)

Reprints of My Editorials from *73*. Very few things in this world are as we've been taught, and as they appear. I blow the whistle on the scams around us, such as the health care, our school system, our money, the drug war, a college education, sugar, the food giants, our unhealthy food, fluorides, EMFs, NutraSweet, etc.

1996 Editorials: 120 pages, 100 choice editorials. $10 (#72)

1997 Editorials: 148 fun-packed pages. 216 editorials. $10 (#74)

1998 Editorials: 168 pages that'll give you lots of controversial things to talk about on the air. $10 (#75)

1999 Editorials: 132 pages of ideas, book reviews, health, education, and anything else I think you ought to know about. $10 (#76)

2000 Editorials: 76 pages (thinner magazine as a result of our slowly dying hobby). $5 (#77)

Silver Wire: With two 5-in. pieces of heavy pure silver wire + three 9V batteries you can make a thousand dollars worth of silver colloid. What do you do with it? It does what the antibiotics do, but germs can't adapt to it. Use it to get rid of germs on food, for skin fungus, warts, and even to drink. Read some books on the uses of silver colloid, it's like magic. $15 (#80)

Colloid Reprint. April 97 article on a silver colloid maker, history, and how to use the stuff. $5 (#98).

Colloid Kit. Three 9V battery clips, 2 aligator clips & instructions. $5 (#99).

Wayne's Bell Saver Kit. The cable and instructions enabling you to inexpensively tape Art Bell W6OBB's nightly 5-hr radio talk show. $5 (#83)

NH Reform Party Keynote Speech. It wow'd 'em when I laid out plans for NH in 2020, with much better, yet lower cost schools, zero state taxes, far better health care, a more responsive state government, etc. $1 (#85)

Stuff I didn't write, but you need:

NASA Mooned America: René makes an air-tight case that NASA faked the Moon landings. This book will convince even you. $30 (#90)

Last Skeptic of Science: This is René's book where he debunks a bunch of accepted scientific beliefs – such as the ice ages, the Earth being a magnet, the Moon causing the tides, and etc. $30 (#91)

Dark Moon: 568 pages of carefully researched proof that the Apollo Moon landings were a hoax—a capping blow for René's skeptics. $35 (#92)

Travel Diaries: You can travel amazingly inexpensively— once you know the ropes. Enjoy Sherry and my budget visits to Europe, Russia, and a bunch of other interesting places. How about a first class flight to Munich, a rented Audi, driving to visit Vienna, Krakow in Poland (and the famous salt mines), Prague, back to Munich, and the first class flight home for two, all for under $1,000. Yes, when you know how you can travel inexpensively, and still stay in first class hotels. $5 (11)

73 Writer's Guide: It's easy, fun, can pad your résumé, and impress the hell out of your friends. $0 (78)

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Turn your old ham and computer gear into cash now. Sure, you can wait for a hamfest to try and dump it, but you know you'll get a far more realistic price if you have it out where 100,000 active ham potential buyers can see it, rather than the few hundred local hams who come by a flea market table. Check your attic, garage, cellar and closet shelves and get cash for your ham and computer gear before it's too old to sell. You know you're not going to use it again, so why leave it for your widow to throw out? That stuff isn't getting any younger!

The *73* Flea Market, Barter 'n' Buy, costs you peanuts (almost)— comes to 35 cents a word for individual (noncommercial!) ads and $1.00 a word for commercial ads. Don't plan on telling a long story. Use abbreviations, cram it in. But be honest. There are plenty of hams who love to fix things, so if it doesn't work, say so.

Make your list, count the words, including your call, address and phone number. Include a check or your credit card number and expiration. If you're placing a commercial ad, include an additional phone number, separate from your ad.

This is a monthly magazine, not a daily newspaper, so figure a couple months before the action starts; then be prepared. If you get too many calls, you priced it low. If you don't get many calls, too high.

So get busy. Blow the dust off, check everything out, make sure it still works right and maybe you can help make a ham newcomer or retired old timer happy with that rig you're not using now. Or you might get busy on your computer and put together a list of small gear/parts to send to those interested?

Send your ads and payment to: *73 Magazine*, Barter 'n' Buy, 70 Hancock Rd., Peterborough NH 03458 and get set for the phone calls. The deadline for the July 2001 classified ad section is May 10, 2001.

President Clinton probably doesn't have a copy of *Tormet's Electronics Bench Reference* but you should. Check it out at **[www.ohio.net/~rtormet/index.htm]**—over 100 pages of circuits, tables, RF design information, sources, etc. BNB530

TELEGRAPH COLLECTOR'S PRICE GUIDE: 250 pictures/prices. $12 postpaid. **ARTIFAX BOOKS**, Box 88, Maynard MA 01754. Telegraph Museum: [http://wltp.com]. BNB113

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NEVER SAY DIE

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they invest in to expand their businesses, and that means more jobs, either directly, or through their buying goods and services from smaller contractors.

Every dollar the rich get from a tax break ends up going into expanding the economy. And that explains why every tax reduction in history has resulted in a stronger economy.

When the government takes money from us in taxes some of it comes back to us in more jobs, but much of these jobs do not contribute to the economy. Like the so-called War on Drugs, which is costing billions. Like the billions in pork, the thousands of government bureaus.

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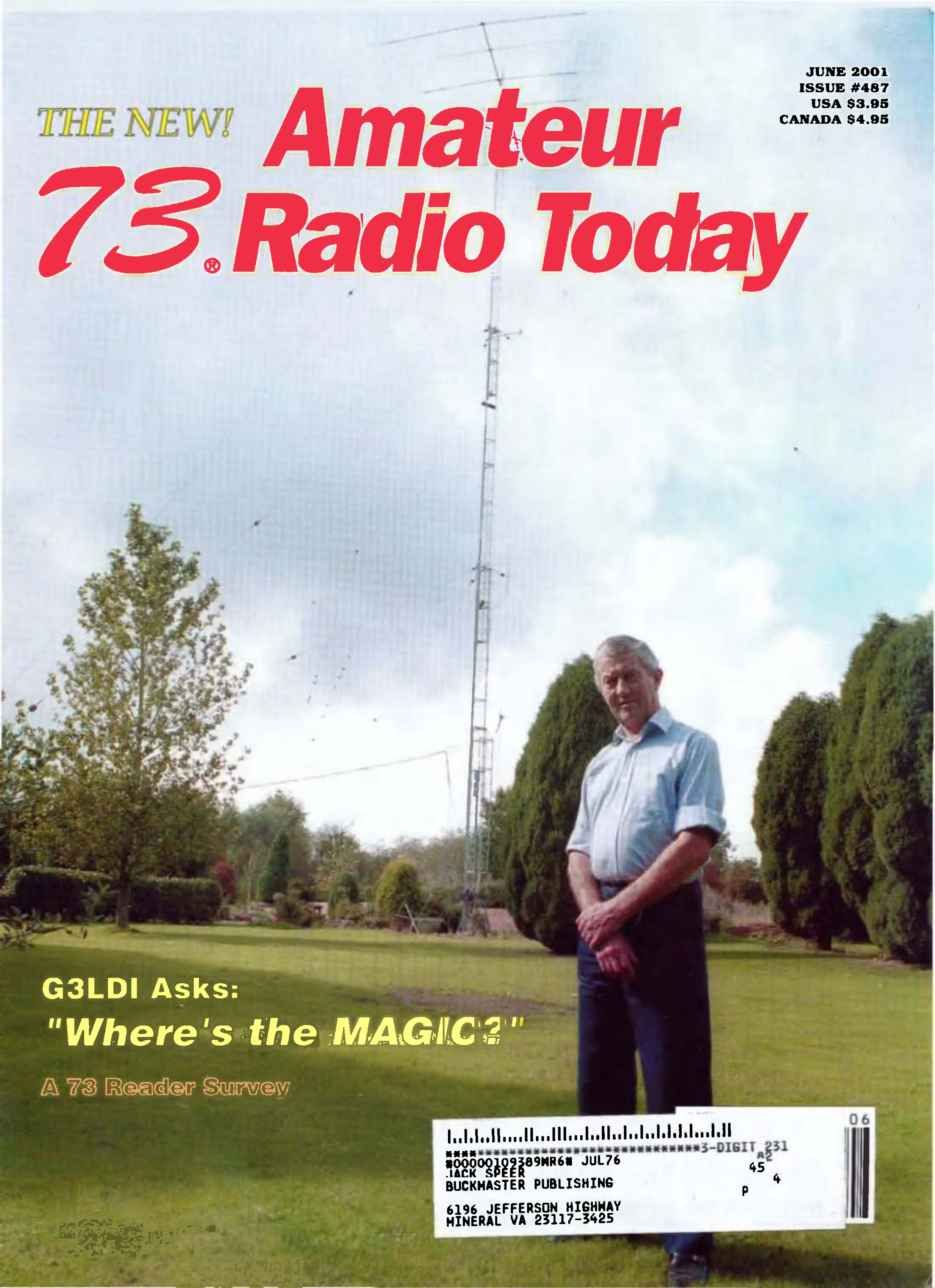
THE NEW! 73® Amateur Radio Today



G3LDI Asks: "Where's the MAGIC?"

A 73 Reader Survey

JUNE 2001
ISSUE #487

THE NEW!

73 Amateur Radio Today

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QRX . . .

For the Birds

As most television viewers have discovered by now, bird chirps and other natural sounds are often broadcast to fill the audio voids in golf tournaments. In fact, viewers have come to expect it.

Now, the *CGC Communicator* reports that bird call experts have recognized that some of those calls are not native to the regions of the tournaments. According to an unidentified Washington communications attorney,

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Yeah, yeah, yeah ... I know summer's upon us and it's time to get outside — if you're that type. But allow me to let you in on a little secret: While everyone else is out mowing the lawn or staying inside to waste their time surfing the Net, you could be firing up the old word processor and whipping off an article for *73* about your latest ham project, or experience, or new product purchase, or ... do I have to spell *everything* out for you?

As thousands of Everyman hams — NOT professional writers — have found out over the years, we pay CASH for your efforts. You couldn't use a couple extra hundred — not to mention the fame? So, call Joyce today at 800-274-7373 and ask for our *How to Write for 73* guidelines. Or — hell — just send it.

Economic downturn? We sneer at it. You can, too.

Lake Wobe...

Hey, guys, let's get on the stick! I'm having a great time swapping pictures with K9TRG, WA3YQY, and others via E-mail — so when are you going to send me some articles on how to send JPEG stuff on the ham bands? And I don't mean by slow scan.

Well, it's been a busy month in Lake Wobe... I mean Peterborough. The Fox TV show on the NASA Moon hoax, aired February 15th and March 21st, sure got that controversy stirred up. The only newspaper coverage I've seen so far was a *USA Today* piece by Michael Medved, who clearly had done zero homework on the subject before writing, lowering him even further in credibility with me than his lame movie reviews on PBS had.

More Moon Madness

If you'll check out www.lauralee.com and download her interview with Bart Sibrel, you'll find out why he says he'll bet his life that the Apollo Moon missions were all faked. He makes a very strong case.

I'd heard about Gus Grissom letting the press take a picture of the Apollo capsule with a big lemon he'd picked from his back yard hanging over it just days before he, Chaffee, and White were incinerated in it. I knew Gus had been critical of the program, but I didn't know that he had submitted a report to NASA shortly before his death citing the many major problems he saw, and how far the subcontractors were behind in their developments. This report, of course, has disappeared.

Getting reliable information on the radiation in the Van Allen Belt has been most frustrating. It seems to be highly classified for some reason, with NASA sitting tightly on it. The best information I've been able to get puts this 25,000-mile-thick belt at radiation about a hundred times that of an X-ray machine. You know, the ones where you have to wear a lead apron and where the doctor or dentist leaves the room entirely. How'd you like to spend 90 minutes in that environment?

Bart pointed out that even though the stars have been reported by astronauts in near Earth orbit to be incredibly bright, not one photo supposedly taken on the Moon was made of the stars. None! And, even more remarkable, not one photo of the Earth was taken during any of the early missions.

And how come they never took even a small telescope so they could take some pictures without the Earth's atmosphere? This was years before the Hubble and those photos could have been very valuable to astronomers.

Oh, yes, the Hubble. You remember the problems they had with that one, and that was just sent up to near Earth orbit.

I didn't know before that Armstrong has never given an interview to anyone since that flight. And ditto Collins. And I hadn't heard about astronaut James Erwin who, soon after becoming a born again Christian, called Bill Kaysing and made an appointment to meet him in three days and tell him the whole story. Two days later he was dead of a heart attack.

Bart was also made suspicious when he found some unreleased photos where objects just a few feet apart cast shadows that faced 90° apart. He was also surprised when he got hold of a video made in near Earth orbit with the astronauts clearly trying to fake pictures of Earth as they might look from much further out in space. The strange deaths connected with the Apollo flights — eleven astronauts within 20 months just before the missions, journalist Baron, astronaut Erwin, NASA spokesman Welch — should raise a red flag for anyone not in deep, deep denial — or a government disinformation agent.

Download the interview from lauralee.com — it's only an hour — and listen for yourself.

More Moon

The DVD version of *A Funny Thing Happened On the Way to the Moon* came in from amazon.com. ($33, with s/h). This 47-minute video is, overall, crappy. Bart Sibrel wrote, produced, and directed it. Phooey. Yes, it has some fine Moon stuff, but Bart wasted a lot of time with political statements — pictures of starving children in Africa, and so on, none of which had anything to do with NASA's Moon hoax.

His resistance piece was some NASA film that was not to be released to the public where Armstrong and Aldrin are in orbit around the Earth taking pictures of the Earth as it would look from halfway to the Moon. The soundtrack picked up their discussion of exactly what they were doing. They managed the effect by putting the camera at the opposite side of the blacked out capsule. The round port made the nearby Earth look like it was a small ball instead of filling the sky. The clouds hid the Earth's features, so it looked like the real thing.

Sibrel also mentioned that he had supposedly been given access by NASA to all of the Apollo 11 trip photos, (man's first landing on the Moon), yet there were only 24 photos! So what happened to the thousands claimed to have been taken?

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the network, which also remains nameless, now admits that prerecorded out-of-area bird calls have been used during some golf tournaments. In fact, some video crews say that they try to attract real birds by placing seeds close to a microphone, but that scheme has yet to yield satisfactory results. Or at least that is what they claim.

But some viewers know the difference, so score one for an educated and attentive audience.

Thanks to CGC Communicator, *via* Newsline, *Bill Pasternak WA6ITF, editor.*

Restructuring: FCC Says No More

The FCC has declined to make any significant changes to the way it implemented Amateur Radio "restructuring" last April. The Commission has turned down several requests for changes in the Amateur Service rules contained in five petitions for partial reconsideration of its Report and Order WT Docket 98-143, released December 30, 1999. The ARRL was among the petitioners.

In a Memorandum Opinion and Order released April 6, the FCC by and large denied all petitions for changes to its restructuring order — although it did claim to grant one ARRL request — and it made some minor housekeeping changes to the amateur rules.

Among the issues was a request from the ARRL and other petitioners that the FCC continue to maintain records that indicate whether a Technician licensee has Morse code element credit. The FCC noted that its current Universal Licensing System software was modified to display a "P" (for Plus) in the field that indicates former license class when a Technician Plus class license is renewed.

"This capability results in the amateur service database being able to provide a de facto Technician Plus licensee database," the FCC asserted in its MO&O. The FCC did not address how its database will distinguish current Technician licensees who subsequently earn Morse code credit. Those licensees have only a Certificate of Completion of Examination which will never be reflected in the database, even upon license renewal.

The FCC also decided to not extend Element 1 credit to all past licensees who had ever earned it — something else the ARRL had asked for. Under current rules, the holder of an expired Novice or a pre-February 14, 1991, Technician license can get Element 1 credit. The FCC said that "most examinees" who ever held a General, Advanced, or Amateur Extra ticket also once held a Novice or a pre-February 14, 1991, Technician ticket that grants Element 1 credit.

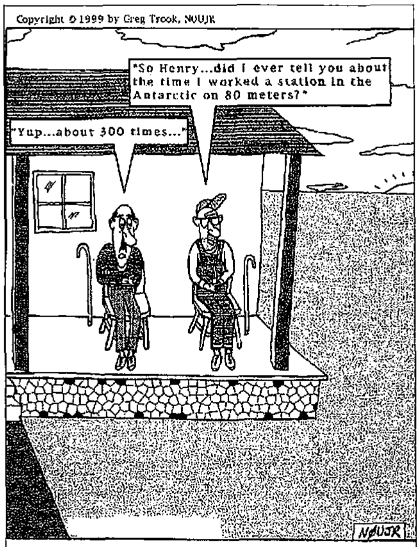
Left out in the cold by the FCC's decision is anyone who went directly to Conditional or General class without ever holding a Novice ticket. The FCC also declined to extend permanent credit to Element 1 CSCEs held by Technicians to obtain HF privileges. These CSCEs are good for 365 days for upgrading purposes but confer only additional operating privileges for Technicians beyond that time.

The FCC refused to reinstate the 20 wpm Morse code exam for Extra. The FCC said that since restructuring went into effect nearly a year ago, "there does not appear to be any decline in the proper operation of amateur stations." The FCC also declined to ban the practice of allowing applicants to retake a failed examination element at a single test session simply by paying a second fee to the VE team. And the Commission did not go along with requests to set the total number of questions at 50 for the Technician and General class test and at 100 for the Amateur Extra test.

The FCC also declined to make any changes — at least for now — in the arrangement of mode-related amateur radio subbands, as some petitioners had requested. The FCC said it believed it should let the amateur community "reach a consensus regarding a comprehensive restructuring of operating privileges for all licensees" before making any changes.

At this point those people who had petitions denied have the option of appealing before the full Commission. If the Commissioners refuse to hear a petition request or deny one after it is heard, the next step would be the federal courts.

Thanks to Brennan Price N4QX, and the ARRL, via Newsline, *Bill Pasternak WA6ITF, editor.*



Old hams don't die..they just become repeaters...

New Digital Mode

A newly created digital mode could make it possible for hams to span the globe on bands like 136 kilohertz. In fact, it's already happened between the UK and North America.

Following recent successes with transmitting extremely slow Morse across the Atlantic on the 136 kHz band, the feat has been repeated using a BPSK data mode. The mode — known as "WOLF", which stands for Weak-signal Operation at Low Frequency — was created by Stewart Nelson KK7KA, and claims to have the weak-signal performance of slow CW without the very long transmission times needed for that mode.

On the 19th of March at 0145, the WOLF signals of MØBMU were successfully decoded by W1TAG. This was only the first occasion that this mode had been used in Europe, though low-frequency experimenters in the USA and Canada had been reporting recordbreaking results for some weeks.

It is likely that WOLF will lead to more LF trans-Atlantic crossings because the reduced transmission times allow advantage to be taken of much shorter propagation peaks than was previously possible.

To learn more about the Weak Signal Operation at Low Frequency, or WOLF, communications, take your Web browser to [www.scgroup.com/ham/wolf.html].

Thanks to Jeremy Boot G4NJH, via Newsline, Bill Pasternak WA6ITF, editor.

Water Alert

We all know that water is important, but have you seen it written down like this before? 75% of Americans are chronically dehydrated (and likely applies to half the world's population).

In 37% of Americans, the thirst mechanism is so weak that it is often mistaken for hunger. Even *mild* dehydration will slow down your metabolism as much as 3%.

One glass of water shut down midnight hunger pangs for almost 100% of the dieters studied in a University of Washington study. Lack of water is the #1 trigger of daytime fatigue. Preliminary research indicates that 8–10 glasses of water a day could significantly ease back and joint pain for up to 80% of sufferers.

A mere 2% drop in body water can trigger fuzzy short-term memory, trouble with basic math, and difficulty focusing on the computer screen or on a printed page. Drinking 5 glasses of water daily decreases the risk of colon cancer by 45% — plus, it can slash the risk of breast cancer by 79%, and you are 50% less likely to develop bladder cancer.

Are you drinking the amount of water you should?

From the Internet.

Continued on page 58

Letters

From the Ham Shack

Brenda Bennett, RR4, Spencerville, ON K0E 1X0, Canada. Carl Bennett VA3LGO became a silent key on January 27, 2001, at the age of 18. Carl received his ticket at the age of 12, with the Iroquois Amateur Radio Club. He was thrilled at getting his license and becoming involved. Carl had an interest in electronics from quite an early age, and always had a number of projects on the go. He looked forward to receiving *The Canadian Amateur* and *73*.

Following Carl's death, we learned that it is more than likely that he suffered from Fetal Alcohol Syndrome/Effects. A number of years ago, Carl told me that he wanted his life to make a difference. Since his death, I believe his legacy to us is to share with others the effects that alcohol and/or drugs can have on an unborn child — the effects of which that child will carry with them and suffer for the rest of his/her life.

Thank you to the Iroquois Club and to all the operators who became his friends through this wonderful hobby.

I'm not sure if it is normal practice for "In Memoriam" letters to be printed, but we did want to let all hams know how much Carl enjoyed being one of them. From Carl, 73 — and thanks!

Ronald W. Bissett W1SWV. I first got my ticket (amateur radio license) in 1948, when I was 17 years old. We had a lot of fun building equipment and communicating with each other, and checking to see how each change we made to our gear either improved or degraded the quality of our transmitted signal. We converted World War II surplus gear to get on new bands with higher power. It was a hobby that was exciting and held the pleasure of accomplishment. I unfortunately let my ticket expire around 1968 because of personal problems. Recently, and with the encouragement of my wife, I took the FCC exams over again and achieved Extra class amateur status. I subscribed to *QST* and ordered what I thought was The Radio Amateur's Handbook (1999), but to my surprise, what I got was the ARRL's Handbook for Radio Amateurs. Somehow the radio amateurs ended up taking second place to the ARRL?? Give us a break, please. Radio amateurs made the ARRL.

I looked through the handbook and I thought to myself, "Where are all the amateur radio transmitter projects that used to be in this great publication?" ... none were found ... save a few QRP items and a high power final amplifier. What a disappointment, to say the least. I wanted to send the handbook back as a publication that did not fulfill my expectations, but I didn't have any, and one is better than none.

QST soon arrived ... what a disappointment it turned out to be ... over what it used to be. Month after month, all I saw were lots of articles of product reviews of their advertisers, too many pages devoted to DX contests and very few worthwhile projects for the "hands on" radio amateur. A sad demise to the real hobby that used to be amateur radio.

I purchased several other ARRL publications and I noticed that a good many of their published articles (which you pay for) refer you to another one of their publications (which you must pay for again) in order to get some specifics on the original article. This is a poor business tactic used to generate additional revenue while treating the radio amateurs like they are a cash cow for ARRL purposes.

There are many of you who will have a different opinion than mine and I will respect that, but I think the real radio amateurs are interested in exploring rather than being led into the belief that buying is better than building. The only thing you learn when you buy completed equipment is how to operate it, but when you build something, you learn ALL about it.

Think about it ... radio amateurs are indeed unique people and should not be treated like cattle being brought to market.

I do not propose to tell you what to do ... but I sure hope you decide to do something different than what has been going on over the years that I have been away from the hobby. And if by some chance you are truly satisfied with things, then you will allow Status Quo to prevail.

Thank you for allowing me the opportunity to express myself.

Daniel NØBN. Since I am interested in ham radio history, I was pleased to see mention of a ham radio history reflector in "QRX" on pages 6 and 61 of your March issue.

I subscribed, but there appears to be nothing about ham radio history on the site: It seems like an unorganized chat room where people periodically send messages and say "What's going on here?" and "I just upgraded." I unsubscribed.

Just thought you might like to know.

I note, however, that the historical treatment of ham radio from the '30s, "Two Hundred Meters On Down," appears to be for sale on the ARRL site. I had thought it was out of print.

The most snow in decades in New England might lead the skeptical to suspect the validity of the frantic global warming cries. This letter from geologist Jack Sauers is relevant.

Jack Sauers, geologist, 6240-5th NW, Seattle WA 98107. Due to the heat island effect, and some slight ocean warming, related to the solar retrograde cycles, and oscillating El Niños and La Niñas, those in the cities of North America believe, as a result of much propaganda, that there's anthropogenic warming, and from their point of view, the natural cycles that have controlled the climate in the past, are of little importance.

This has lead to an arrogance amongst environmentalists, and a smug complacency, that nature no longer has an effect on their lives, and a "Save the Earth Theology or Religion" and a control over the newspaper and television media in the US and many other places in the world. A power struggle has resulted, and a tie in American Politics from this fixation and syndrome.

The powerful 150–180 year solar retrograde cycle of the climate that produced a top in both annual and summer temperatures in the middle part of the Twentieth Century, and a decline since in the better onland weather stations I have studied, has been found to be present for many repetitions in GISP2 drill cores, as well as those in Antarctic cores in oxygen isotope temperature data, sea core data, as well as tree ring data, in California redwoods, oaks in Europe, as well as cedars in Japan.

That Interdisciplinary Climate data on the dominating natural cycles is superimposed on longer natural cycles of solar and orbital cycles of about 20,000, 40,000, and 100,000 years, that will not be rescinded by nature, no matter how much pontificating is present by the self-appointed divinity of the anthropogenic or global warming aristocracy.

Continued on page 57

John Pivnichny N2DCH
3824 Pembrooke Ln.
Vestal NY 13850

EZ-Build Preselector

Use a tuning cap from an old broadcast receiver.

*The price of new variable capacitors is so high that recycling is now very attractive. High-quality tuning capacitors like the one shown in **Photo A** can be found in old AM and AM-FM radios. This one came from an old Zenith set and has a double ball bearing on the front.*

Restoring the capacitor involved removing it from the radio. A string-driven drum was unfastened from the drive shaft. The bearings were dry so a drop of household oil (3-in-One) was applied to the front and rear bearings. And dust was wiped off the frame (not the plates).

So what can you use it for? Well, most AM tuning capacitors have about a 300–400 pF maximum capacitance and close spacing, so high-voltage applications are out. This one also had a second section of smaller plates. I decided to build a preselector using it as the main tuning element.

What is the tuning range?

A quick way to check the tuning range is with the circuit shown in **Fig. 1**. The capacitor is connected in series with a powder iron toroid and a 51 ohm resistor. An MFJ SWR analyzer is then connected and tuned for minimum SWR. Take a reading with the capacitor plates fully meshed and again with them fully opened. These two readings will give you the frequency ratio for that capacitor. For AM capacitors, it should be about 3:1, because they had to tune 540–1600 kHz (the AM band is now 530–1710 kHz, but back when the capacitor was made, it was 540–1600). So, 1600/540 = 2.96.

The back section on my capacitor had a measured ratio of about 4:1, and the smaller front section measured 2.5:1.

With these figures, I decided my preselector would cover the entire high frequency spectrum from 1.5 to 30 MHz in three bands. The smaller capacitor section is used for the highest frequencies, and the back capacitor for two lower bands. A rotary switch and three powder iron toroid cores are all that is needed.

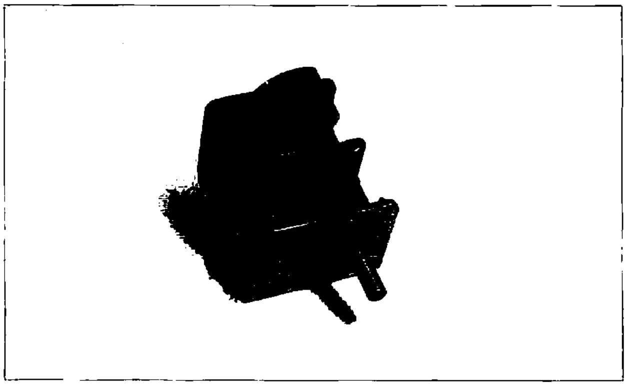


***Photo A.** Tuning capacitor rescued from an old AM-FM radio.*

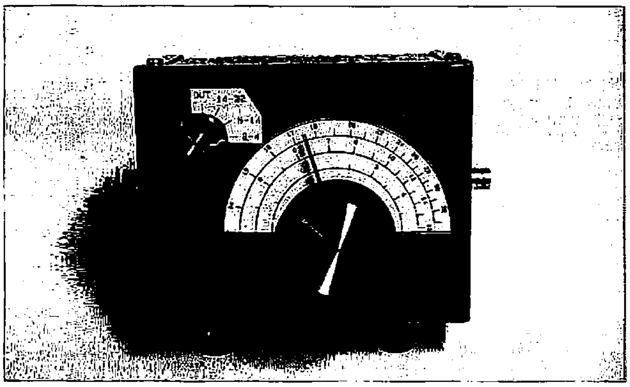


***Photo B.** Completed preselector.*

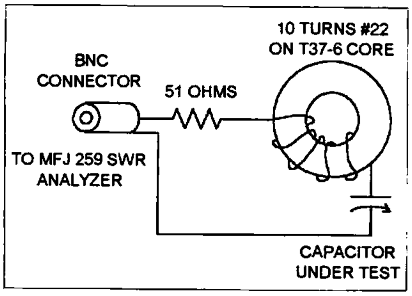


Fig. 1. Circuit to check tuning range.

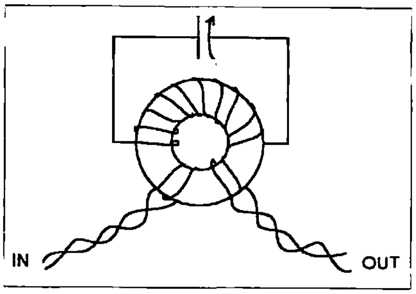


Fig. 2. Basic preselector circuit.

The preselector

A preselector works by passing frequencies near its resonant frequency and rejecting others. This is just what is needed at the front end of a receiver to knock down those strong out-of-band signals, which can otherwise get into a receiver mixer circuit. Those signals cause intermodulation signals to appear within the band you are listening to, often drowning out the signals you want to hear.

Fig. 2 shows the basic circuit for a preselector. A powder iron toroid coil of the proper inductance is wound to allow the capacitor to tune the desired range. It's important to use an inductor with a high Q so that the passband, the range of frequencies passed by the preselector, will be narrow. Table 1 gives the details for the three inductors chosen. Note that according to Micrometals data, a T44-10 toroid provides a higher Q than a T68-10 in the 14–32 MHz range.

You may want to select other coils depending on the characteristics of your "rescued" tuning capacitor and the frequency ranges you want to cover. The values in **Table 1** serve as a good starting point. **Fig. 3** shows the complete circuit for the three-band preselector.

Construction

All the parts should be mounted in an appropriate-size shielded enclosure. **Photo B** shows the completed project. I used BNC connectors, a 3 pole 4 position rotary switch, the tuning capacitor, and the 3 toroids of **Table 1**. The enclosure is an aluminum box 5"x4"x3". The two higher-frequency toroid coils are self-supporting by the stiffness of the windings. However, the lowest frequency coil (L1) must be mounted. I suggest a single nylon 6-32 screw, washer, and nut through the center, mounting it on a short piece of G-10 printed circuit board insulator. The circuit board is then mounted to an enclosure wall with a short piece of 1/2-inch aluminum angle stock.

Calibration

A large pointer knob and a calibration scale as shown are very helpful in the approximate setting and identifying of frequencies. Use a signal generator and RF voltmeter to calibrate the preselector. A temporary scale such as shown in **Photo C** can be used to take initial readings, and then a more final scale can be drawn and mounted.

Photo D shows the calibration setup I used. An MFJ 259 SWR analyzer is used as a signal generator, followed by

Preselector Inductors						
	Frequency Range	Core	Turns	Inductance µH	Q	Link (each)
L1	1.5–5	T68-2	72T #30	30	230	5T #26
L2	4.5–15	T68-6	25T #22	2.5	280	2T #22
L3	14–32	T44-10	13T #20	0.7	170	2T #22

Table 1. Inductor details.

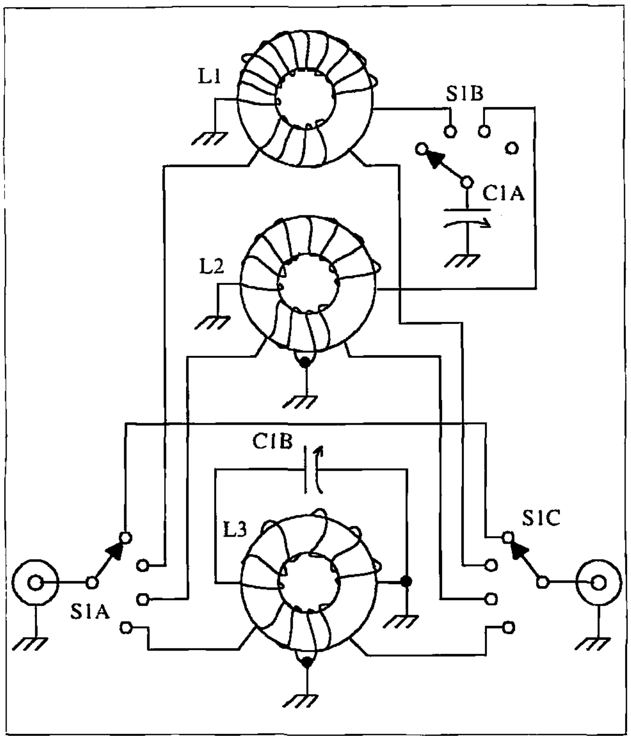


Fig. 3. Schematic of complete 3-band preselector. L1, L2, L3 — see Table 1. C1A — back (larger) section of "rescued" capacitor. C1B — front (smaller) section of capacitor. S1A, B, C — 3-pole, 4-position rotary switch.

a step attenuator. The signal enters the preselector through one BNC connector and exits through the second BNC to the RF voltmeter. When the preselector is tuned to the same frequency as the signal generator, a definite peak in RF voltage is indicated.

Conclusion

A preselector like this can also be built right into a receiver, providing much improved spurious frequency rejection. It's an enjoyable project to build, makes good use of a recycled part, and keeps one more thing out of the landfill.

For further reading

The step attenuator of **Photo D** is described in the article, "Build a Step Attenuator," *Electronics Now,* April 1999, pp. 34–37; correction, June 1999, p. 7.

The RF voltmeter of **Photo D** is described in the article, "dBm Meter," *Electronics Now,* November 1995, pp. 112–113, 158–159.

Considerable information on building high-Q inductors can be found in the book, *Radio Components Handbook,* Guido Silva I2EO, MFJ, Starkville MS 39762; 1998, available through Barnes and Noble and other bookstores.

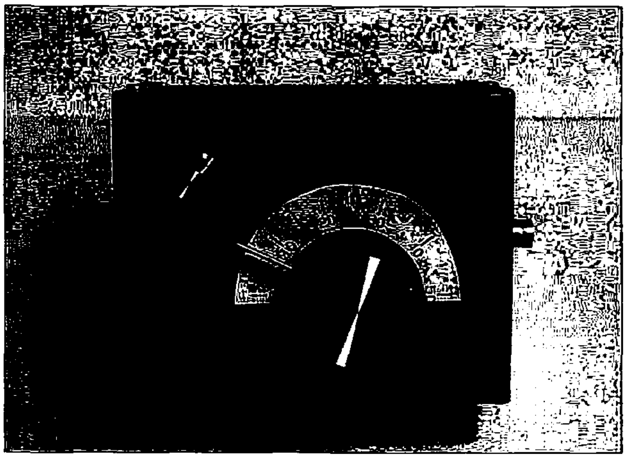


***Photo C.** Use of a temporary scale for calibration.*

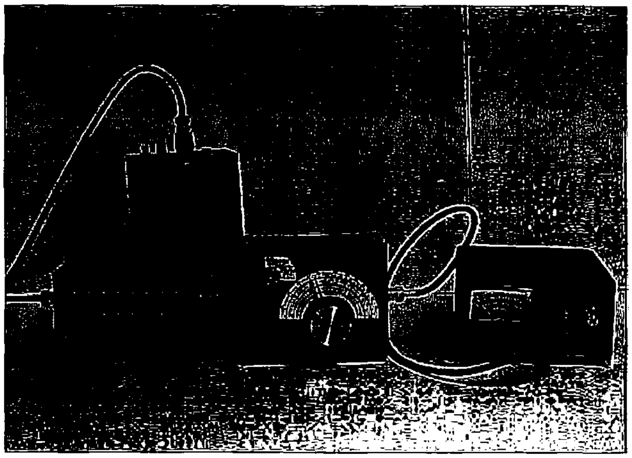


***Photo D.** Calibration setup.*

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Kenwood's Hot New TS-2000 — Part 2

Could YOU handle all these features?

In last month's issue, we provided a primarily hardware-oriented examination of this formidable new offering from Kenwood. This month, we are peeking under the hood of those features that are more firmware- and remote control-oriented, as well as some software that Kenwood has just introduced.

What better place to begin than on the screen of your home computer? The vast majority of ham shacks these days include some form of personal computer as an operating aid. With that in mind, Kenwood has introduced the ARCP-2000 software package (and the TS-B2000 as well). It is a nifty program that actually provides a feature or two that are not front-panel-addressable.

In the beginning of April, Kenwood placed the ARCP-2000 CD-ROMs on the local dealer's shelves. I checked the price at that time, and it was right about $80. As far as system requirements go, Kenwood recommends a 133 MHz (or faster) Pentium® or equivalent running Windows® 95 or better. The display is set up for 800 x 600 resolution, and requires a mouse and a keyboard. I recommend a Microsoft IntelliMouse 1.1A or equivalent that has the cursor wheel between the right and left buttons (more on that later). ARCP-2000 communicates with the TS-2000 via COM 1 through 4, and requires no level shifting or null modem adapters. The program installs in just a few minutes. My installation was error-free on a 400 MHz Pentium II with 256 megs of RAM. I recommend that if you intend to use this program with others in the stack, you should have a minimum of 64 megs of RAM on board.

As you can see in **Fig. 1**, all of the main front panel features of the TS-2000 are arrayed in a logical pattern. Many of the vernier controls such as volume, squelch, RF gain, and manual notch tuning are there as well. Now, I

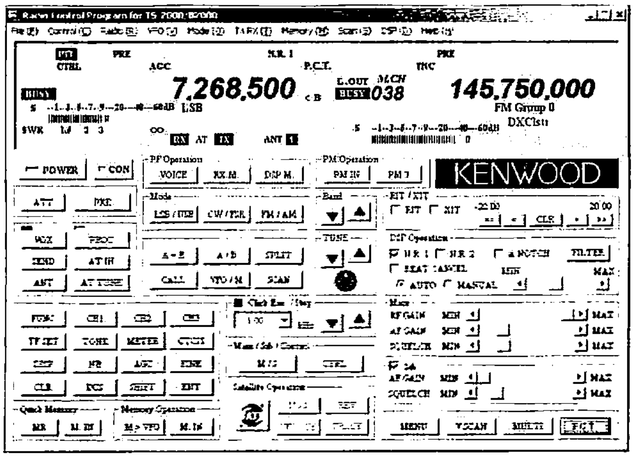

Fig. 1. This is the main panel display of the ARCP-2000 software. (N6NR screen capture)

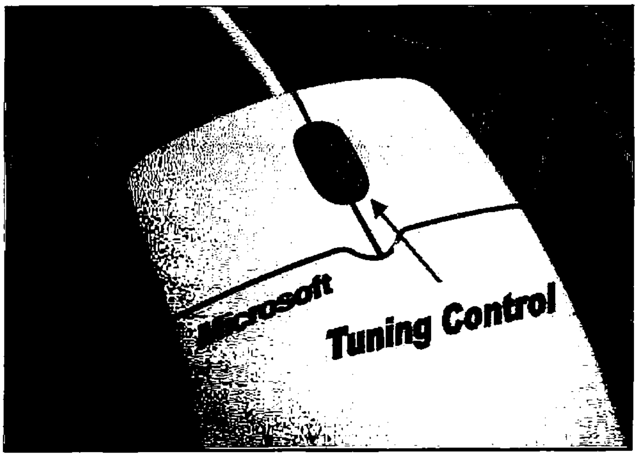

***Photo A.** If you have an IntelliMouse, you can tune the radio with the cursor wheel.*

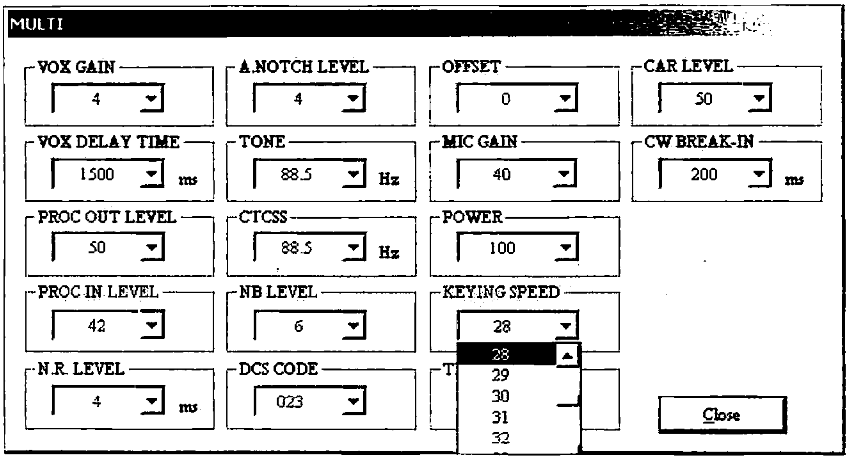

Fig. 2. The MULTI panel may be used to control the dynamic features of the radio. This figure shows how easy it is to change keying speed on the fly.

know that I raved about the feel of the VFO last month, but I have to tell you that I also enjoyed being able to tune the radio with my mouse. There are two ways in which the mouse may be employed to tune the radio. You may click on either the up or down arrow to move up or down in frequency. Tuning of the radio is also accomplished by clicking on the little tuning knob in the center. It will light up with a green background. All you need to do is press the right or left button on the mouse, and move the cursor in a circular motion to tune the radio. The right mouse button moves you up, and the left, down.

Did I say there are two ways to manually tune the radio? Well, I lied. There are three. If you have a mouse with a cursor wheel between the left and right buttons, you can tune up frequency by rolling the wheel forward, and down by rolling it backward (see **Photo A**). This is a very convenient feature, and it tells me that Kenwood is paying close attention to relatively recent developments in user interface to the PC.

Many of the dynamic feature settings of the radio are controlled with the FUNC key, and the MULTI/CH knob. The ARCP-2000 software provides direct control of these features as well. Double-clicking the MULTI tab in the lower right-hand corner of the main panel brings up another panel shown in **Fig. 2**. The mouse may be used to click open the settings, and another click on the desired level sets it in place immediately. If you're like me, I like to leave that panel open, especially if I am working CW.

Remember how I raved about the Packet Cluster Tune (PCT) feature? The ARCP-2000 software package definitely adds value to PCT. This feature may be selected with a single click on the PCT tab in the main window. When PCT comes alive, another window opens, as shown in **Fig. 3**, which provides a list of the most recent spots. By clicking on the spot, and then on the SET tab, the radio will tune to the frequency of that spot. I'm still a "kid in a candy store" when it comes to that feature. I love it!

If you are familiar with the TM-D700A, you already know about Kenwood's Programmable Memory (PM) feature (I like to call it Panel Memory). This feature allows the user to set up the D700 in any of five preset configurations which include frequency, memory, offset, deviation, panel display intensity, and so on. As it turns out, that feature is present in the TS-2000 as well, although I can't for the life of me figure out why they didn't make it available from the front panel (maybe they did, and I just haven't found it yet — just kidding). The ARCP-2000 main panel has tabs that can be selected to set and manipulate that feature. When you are satisfied with the way you have the radio set up (like in CW mode, with a tight filter and the like), click on PM-IN above the tuning controls. The 1–5 keys will light up (orange). Click on the desired numbered key, and the radio's configuration is stored. If you want to go back to that setting, just click on PM, the numbered keys will change color again, and you may select the previously stored configuration. You may also turn PM off, which is in effect a sixth configuration setting. As I am the owner of two TM-D700As, I use this feature a lot.

Filter design

In my estimation, the key feature of both the TS-2000 and the ARCP-2000 software is the ability to manipulate the transmit and receive filters in DSP. Kenwood has leveraged their experience with the TS-570 and TS-870 in bringing this feature forward. Perhaps I'm biased, but here is where Kenwood is light-years ahead of its targeted competition. Not only does the TS-2000 provide the capability of vernier control of the receive filters on the fly

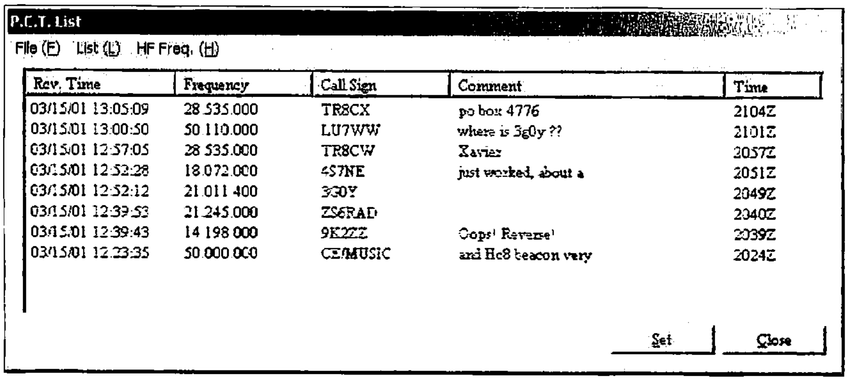

Fig. 3. This is the spot list window in the packet cluster tune mode.

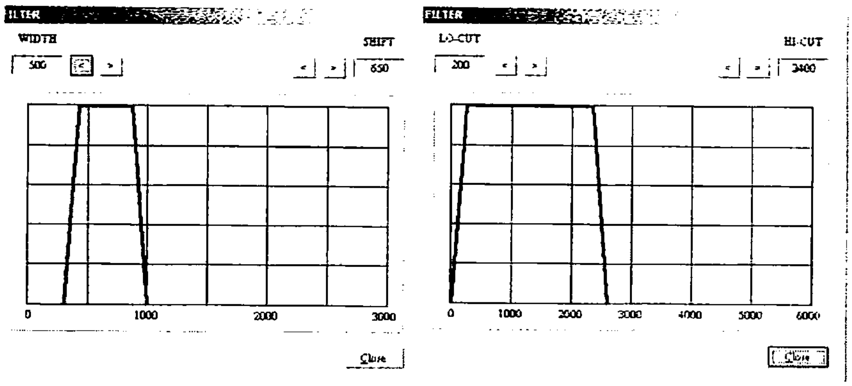

Fig. 4. Here are two views of the vernier filter control panel. The CW filter is on the left, and the SSB filter is on the right.

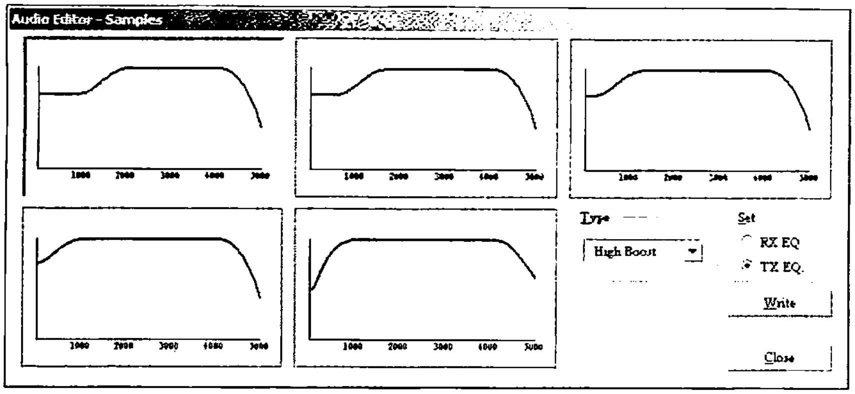

Fig. 5. Here is an example of the five high-boost filters that are available for user-selectable transmit audio equalization.

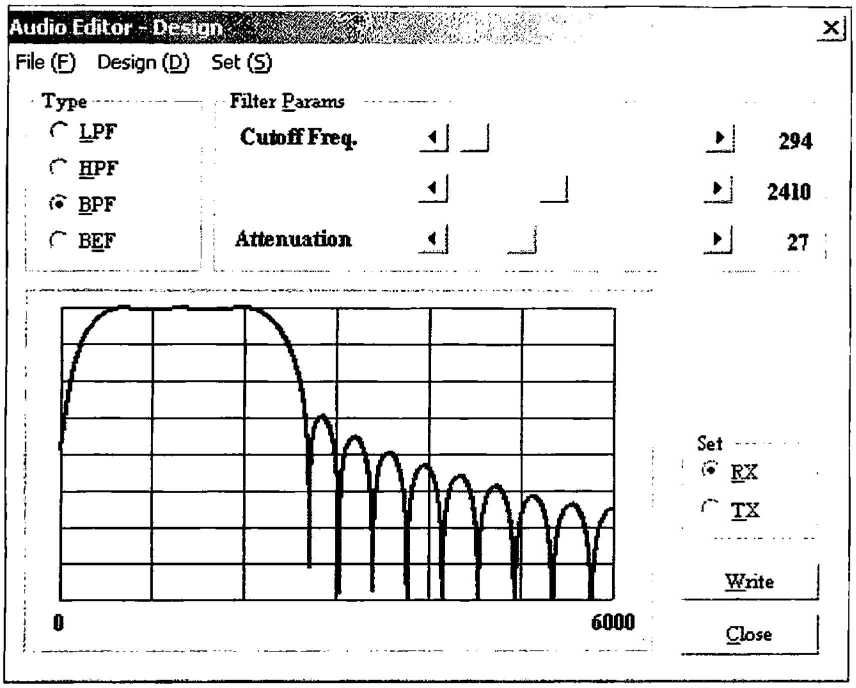

Fig. 6. Using the Design (D) feature, I have designed a digital receiver bandpass filter that operates from roughly 300 to 2400 Hz, with a first-order attenuation of roughly 30 dB. All I need to do is click on the Write tab, and select User from menu 20 to employ this filter

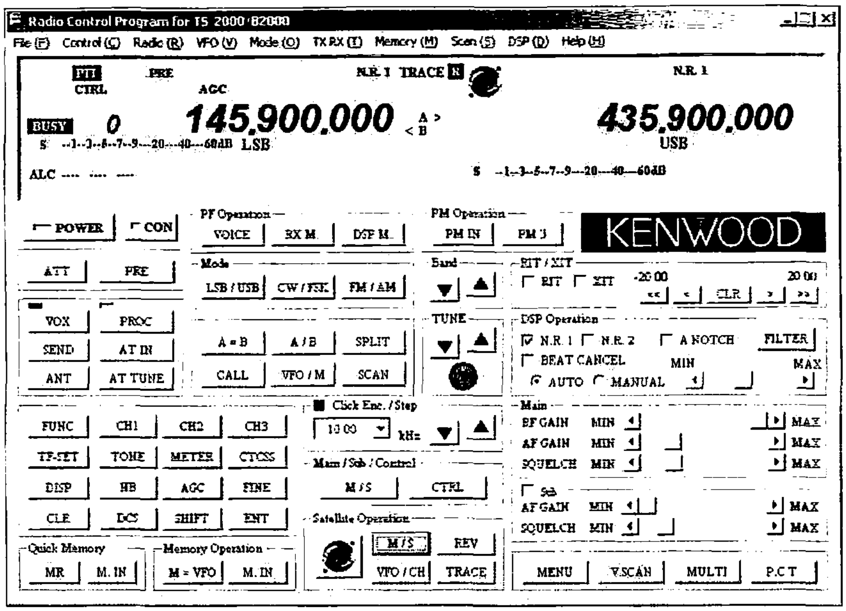

Fig. 7. Here is the main panel in Satellite Mode. The TRACE icon is synonymous with the frequency tracking mode found on other transceivers that have Sat mode capability.

(see **Fig. 4**), but the user may design her or his own filter shape for both transmitter and receiver audio.

Within the ARCP-2000 menu is a control that allows the standard filter shape control found in the front panel features of the TS-2000 to be used. This is found in menus 20 and 21 (RX and TX Equalizer). By pulling down the DSP menu (on the ARCP-2000 upper menu bar) and selecting the Audio Editor, the operator may select two user-defined filter modes. One is called Samples (S), and the other Design (D). The Samples menu provides predefined filters for both the transmitter and receiver that can be written to the radio. There are seven filter categories that range from bass-boost, to flat response, to high-boost, with a couple of specialized shapes thrown in as well. Under each filter type, there are five shapes that may be selected, for a total of 35 predefined filters. That is quite an array all by itself.

If you have a physical limitation (like partial hearing loss) that can be mitigated by a special filter shape, or if you are among a growing number of SSB operators who enjoy expanding the range of audio characteristics that your transmitter can emit, then you will appreciate the Design feature. This allows the operator to directly control the frequency limits, shape, and attenuation of any transmit or equalization filter that may be written to the radio, and selected under the transmit and receive equalizer menus. I am simply amazed at the versatility that this provides. I had a chance to play around with some PSK31 prefiltering of the RX and TX audio, and was very pleased with the results.

Remote control features

I promised that I would talk a bit more about some of the remote features such as microphone control, wireless remote control, Sky Command, and Crossband Repeating. First of all, the microphone control feature is very similar to that of the D700. A number of the microphone buttons may be programmed to provide many of the control and menu functions. I have my microphone set up to switch between SUB and MAIN, between Memory and VFO, enter the SCAN mode, and open the squelch in MONITOR mode, as well as manually enter a frequency into either VFO, vernier the frequency, and a few other repeater-oriented functions. In short, the microphone is a viable tool for controlling often-used features and modes of the radio.

A subset of these features may also be controlled via another radio with a DTMF encoder. A TH-D7A is particularly useful in that it can automatically

Photo B. *Pardon the parallax in my close-up lens. Here is a picture of the RC-2000. Anything look familiar to you D700 owners?*

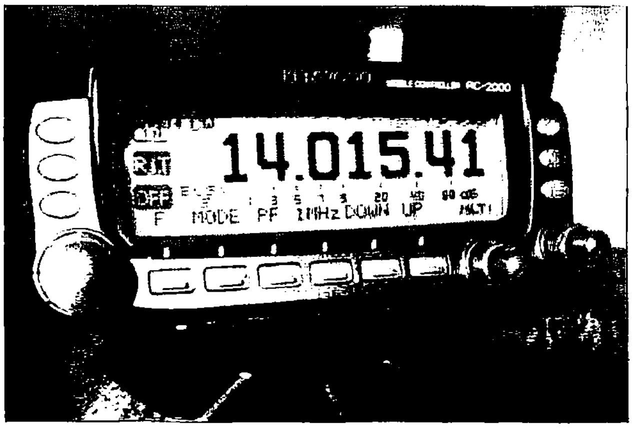

Photo C. *This is the EASY viewing mode. This is very handy when you are cruising down the road, and can't find your reading glasses (that's never happened to ME, of course).*

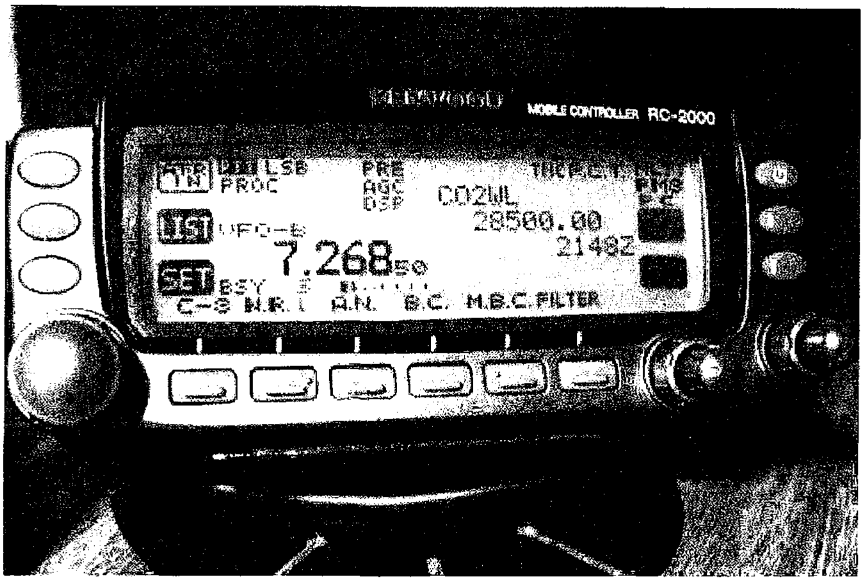

***Photo D.** Notice how the PCT DX spot information is displayed in an aesthetically pleasing cascaded fashion in the SUB window.*

transmit the "password" required to precede each command. Without it, you need to send the password before each command sequence. From another radio you can basically control the VHF/UHF portion of the radio. You can turn DCS or CTCSS on and off, select the tone frequency, enter or leave the REPEATER mode (transmit offsets), switch to low power, and toggle between VFO and Memory. I tried it and it works very well.

The real fun mode is Sky Command II. Because of certain ill-conceived regulatory limitations, I had to test this feature on the bench with dummy loads (don't even get me STARTED on this subject). My D700 worked in perfect concert with the TS-2000. So as not to encourage you too very much, all I will say is that Sky Command II works as advertised, and is a fun feature. Use it at your OWN risk. I might add that the Cross-band Repeat function works very well on its own, and unlike some other transceivers I have used, I was able to enter repeat offsets and CTCSS tones. One must be very careful, however, not to put the TS-2000 into a mode that will cause interference to other amateurs on repeater or simplex frequencies. Please be diligent about this, won't you?

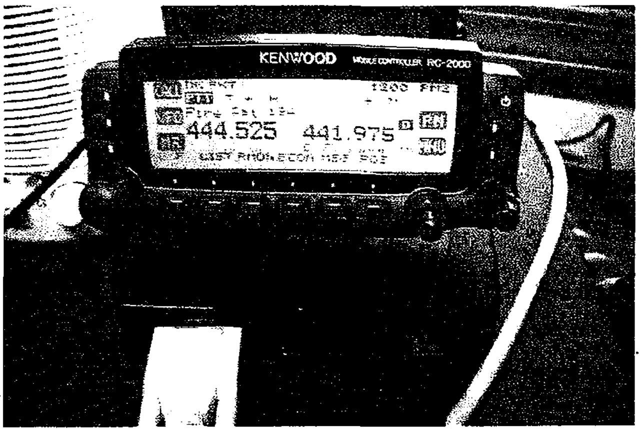

***Photo E.** Here's another note to TM-D700A owners. Remember when you opened the box for the first time? Remember that little warning note that said that you couldn't buy the control head separately if it gets stolen, or words to that effect? Well, your worries are over. If that untoward event should occur and you are left with a headless radio, just buy an RC-2000. It has the ability to sense whether it is connected to a TM-D700 or a TS-2000, and switch into the display mode that corresponds to the radio it is connected to. Here's my RC-2000 (oops, did I say 'MY?) connected to the D700 in my shack. BEYOND AWESOME!*

Satellite mode

With the press of one button, or click of a mouse (if you are using ARCP-2000), you may enter the world of full-duplex satellite operation. I was very pleased to learn that the SAT mode also works with the HF spectrum. In-band full-duplex operation is not an option for obvious reasons.

There are some interesting features that are useful. The first is the ability to store 10 satellite configurations, and give them an alphanumeric label for easy recollection. Second, the radio provides the operator with the ability to monitor his or her own frequency with the push of a button. This is needed to provide due diligence in ensuring that you are not hammering someone else locally while trying to make a contact. The TRACE mode gives the operator the ability to track the offset between the uplink and the downlink without the obviously poor practice of sending a string of dits, or imitating Andy Griffith by yelling "hello" into the microphone until you hear yourself coming back through the "bird." TRACE will operate in direct or inverse proportion to your transmit frequency depending upon the type of translator employed on the satellite. It also may be shut off if translator tracking is not required.

I must say that having all of the DSP toys available while making a satellite contact is a real blessing.

The RC-2000 remote control head

If you own a camper or a motor home, you MUST get one of these! The folks at Kenwood sent me one to facilitate my review, and now they're going to have to hunt me down to get it back (just kidding — or am I?). D700 owners will recognize this little device immediately, as it is the same display and enclosure as the control head for their radio (see **Photo B**).

The RC-2000 will allow the operator to do just about anything he or she could from the front panel of the TS-2000. It will also allow setup, storage, and retrieval of those PM functions I talked about earlier. It is all menu-driven. Once you get the hang of

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73 Review

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Up-'n'-at-'em Stealth Vertical

The Outreach 500 was the perfect solution for this ham.

Stealth amateur radio operation is sometimes necessary due to restrictive covenants or other mandated requirements placed upon property owners, some of whom happen to be hams. Stealth operation may also be a choice so as to prevent unwanted and undeserved criticism or blame from neighbors who think every glitch in their home is caused by the local amateur radio operator.

In an attempt to keep the neighborhood peace and still enjoy the fine hobby of amateur radio, one solution to HF operation will be described here. This method has been successful for me and has yielded many HF contacts in the continental United States, as well as DX work.

Overview

It all started when I wanted to set up an antenna for HF work. The property does not contain any high natural structures, such as trees, to lend a hand as vertical supports for wire-type antennas. A tower was not in the plan at this time, due to other considerations. The house itself is a ranch-style home, so there was not much in the way of vertical help here for a tall support. Attention turned from a wire antenna to a vertical antenna for the solution.

Now, what vertical to use? There are many to chose from, each having their own plus and minus considerations. After much deliberation, I decided to use the Outreach antenna with the Outpost tripod/ground coupler mounting unit. I bought the Outreach 500 because it handles more power than its almost-twin, the Outreach, and it is more stout in its construction. It is made beefier in order to handle the higher power.

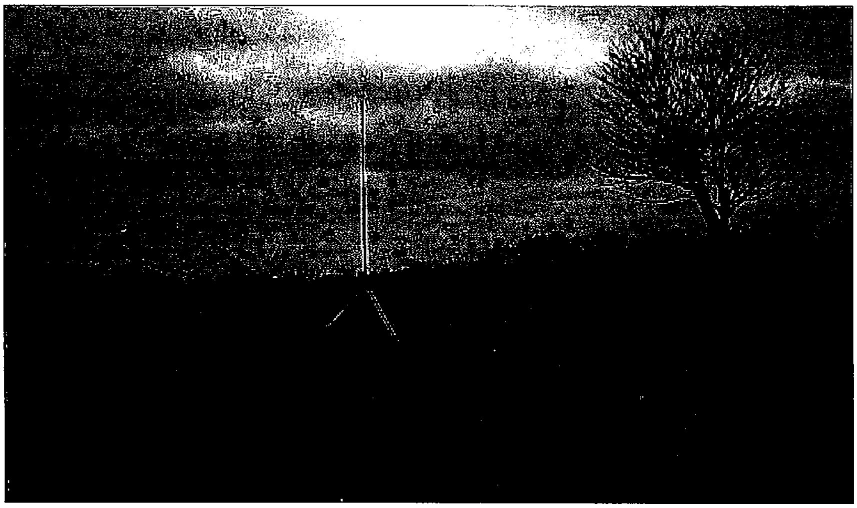

Photo A. The Outreach 500 is a little hard to discern — perfect, if you need a little stealth!

Practical usage

The Outreach antenna would have been fine, too. Aside from power handling, the bands available on each model are slightly different. The Outreach 500 has 80/75 meters through 10 meters, as well as 6 meters. The Outreach offers 160 through 10 meters but no 6 meter tap.

Physically, the antenna is 12 feet tall. Two 4-foot sections, which contain the band taps, thread together, and the top section is a 4-foot-long "stinger." The stinger is adjustable for VSWR, for those who desire to do so. It has a convenient score scribed near the bottom end for easy reference to adjust from. Leaving it set on the score mark has worked well for me.

The base, called the tripod/ground coupler mount, is a neat piece of

equipment. The antenna mounts to it using a 3/8-inch x 24 threaded base piece. It is made of a good grade of aluminum and has stainless steel hardware. In fact, no tools are necessary to put it together — although I did use slip-joint pliers to give the threaded base a snug when attaching it to the tripod base piece. Wing nuts are used at the joints where tightening is done.

There is an aluminum plate at the bottom of each leg of the tripod to "couple" to the ground. I have found this to work very well. No additional radials are used, even though the soil here is typical of western Pennsylvania — rather high in clay content and not the greatest for conductivity. A hole is in each of the plates, to insert a tent peg or similar stake to secure the tripod to the ground. I have not found this necessary. The antenna has a low wind profile and has not moved or toppled over in the location where it has been placed. It is subject to wind and gusts, as I live on top of a hill in the open where the wind can be brutal at times. The tripod is easily folded up for transport if portable operation is needed.

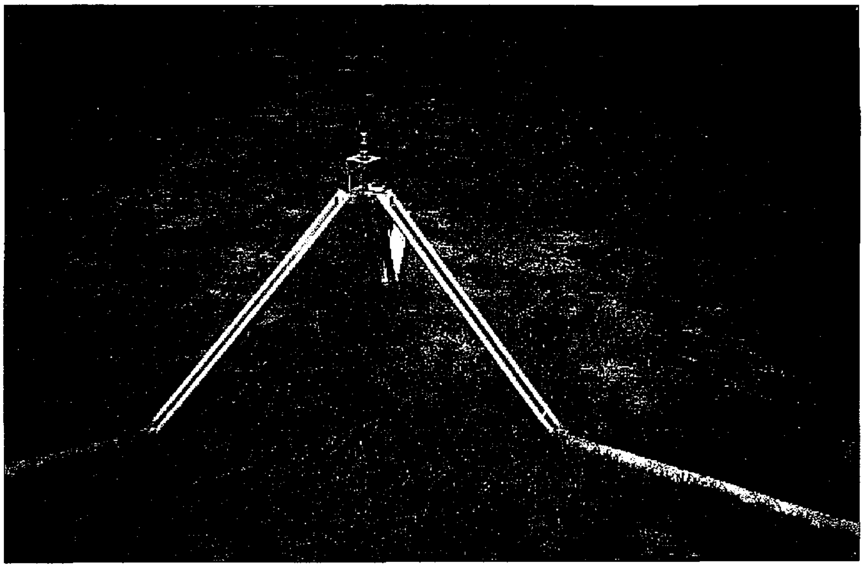

Photo B. Up-close look.

	Meters	Lower Band Edge	Band Midpoint	Upper Band Edge
Band	75	3.500	3.750	4.000
VSWR		>5	>5	>5
Band	40	7.000	7.150	7.300
VSWR		3.0	1.2	3.0
Band	30	10.100	10.125	10.150
VSWR		1.63	1.75	<2.0
Band	20	14.000	14.175	14.350
VSWR		1.75	1.45	1.45
Band	17	18.068	18.118	18.168
VSWR		1.35	1.35	1.4
Band	15	21.000	21.225	21.450
VSWR		>5	1.75	>5
Band	12	24.890	24.940	24.990
VSWR		2.75	3.0	>3
Band	10	28.000	28.850	29.700
VSWR		3.0	2.5	>5
Band	6	50.000	52.000	54.000
VSWR		Not Done		
Notes: 1. Freqs given in MHz. 2. VSWR values given :1.				

Table 1. Outreach 500 VSWR.

VSWR measurements for my antenna are given in **Table 1.** If you use a criterion of less than 2:1 VSWR, the antenna is usable without a tuner on some of 40 meters, and all of 30, 20, and 17 meters. Also, a limited portion of 15 meters was less than 2:1. For the other bands, the VSWR is higher than this criterion, but a tuner should make matching 50 ohm impedance possible.

Conclusion

This antenna system has worked well for HF operation. The antenna with the tripod is pricey. Granted, there are less expensive ways to go, but the quality of the materials used here is very good. The band tap wire lead must be manually moved in order to change bands. This might be more of an inconvenience than a problem. It is easy to change the tap, but keep a ladder handy, as some of the tap points are above the average reach. The tap points are angled downward so as to shed rain and snow — a good consideration in antenna design.

This system is great for portable operation such as Field Day, special events, demonstrations, etc. No traps are used, so problems associated with them do not exist. The antenna breaks down easily and a cloth case was supplied to carry the sections. The tripod merely folds up for transport, even in the smallest of vehicles. The system is rugged, nicely designed, yet simple. It has worked very well for my style of HF operation.

Outbacker is distributed in the United States by Alpha Delta Communications, Inc., P.O. Box 620, Manchester KY 40962; tel. (606) 598-2029; fax (606) 598-4413. The Outreach 500 antenna can be purchased at any number of amateur radio equipment retailers, such as Amateur Electronic Supply and Ham Radio Outlet. It lists for about $439.99. The Outpost tripod/ground coupler lists for about $199.99. 73

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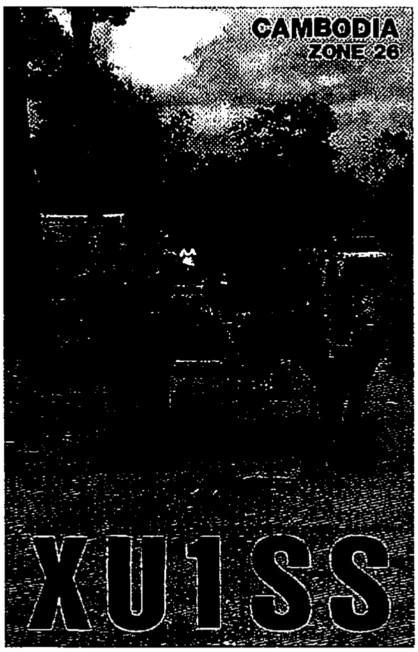
Bring Back the Magic!

Is this guy living in a dream world? YOU tell US.

Once upon a time, there was a young lad who wanted to become a radio amateur. It all started when he read about building a crystal set in a book called the Boys' Own Paper. *This publication is no longer in print, of course, and crystal sets have long since bit the dust! However, for me the seed was sown at that time and I was hooked — on radio. I wanted to be able to make something that I could listen to distant radio stations on, other than my parents' Murphy 10-valve radio. I also tuned around the shortwave bands on this radio and managed to hear hundreds of stations, and interesting sounds.*

In the early 1950s money was tight, and it took a long while to save pocket money to buy components at the local radio store. However, this I managed to do, and together with birthday presents and Christmas presents, I constructed a crystal set on a breadboard, just as the book said. I had no headphones, and had run out of money! My uncle came to the rescue; he had a pair of headphones saved from the second world war, and these provided me with my audio. In the meantime, I had erected a long piece of wire from the house to the bottom of the garden as an antenna. Upon hooking this to my crystal set, imagine my delight when, fiddling with the cat's whisker, a station could be heard in my phones. My parents were duly impressed, and I was on my way.



After a while, and much reading of books from the library, I decided to build a valve receiver. Using a super-regenerative circuit, with HT and grid bias batteries, not to mention an accumulator for the heaters, I made this receiver. The two valves came from the local radio shop and cost a fortune. I had saved for a long time for these. Proud as punch of my new receiver, I demonstrated it to my uncle. In my haste, I connected the HT battery to the LT terminals. I was devastated; you don't get a second chance with such a stupid action, and I paid the price! I could not afford to replace the valves, so I left the radio on the shelf. One day, my friends and I were walking around the town and we came across a second-hand shop selling all sorts of radio bits and pieces. We went in and I could not believe my luck as I found those two valves I needed, at a fraction of the cost I had paid originally! Needless to say, we never visited the high-street shop again!

I managed to repair the radio and was enjoying listening, when I heard a strange station, who appeared to be talking to somebody in Holland. Well, I eventually found out it was a local radio amateur. I also managed to find out where he lived, and was invited to the local radio club. This was the start of my amateur radio activity.

I served my shortwave listener apprenticeship over the next few years and in the meantime I commandeered part of my father's shed in the garden, where I had an R1155 receiver with an RF27 unit as a crystal-controlled converter for 21/28 MHz. The R1155 was a communications receiver used onboard a second world war bomber aircraft. The modification of the RF27 unit was done for me by Doug G3HUL. I spent many a happy hour just listening on all bands, collecting callsigns, finding out where they were, serving my shortwave listener apprenticeship, as we all did in those days.

I gleaned a lot of radio knowledge from numerous trips to the library. I helped on National Field Day events, attended cluh meetings, and so on. One member of the club invited me around to his QTH, where he had several receivers and other equipment that I had not seen before, an AR88D, and HRO, and such. I was hooked even more! He gave me his old *ARRL Handbook*, dated 1953, and I still have it to this day. It became my bible, and I read avidly and looked with envy at the advertisements in the back pages! Two other amateurs, known in the hobby as Elmers, offered to get me through the radio amateur's examination. Bill Brennan G3CQE, unfortunately now a silent key, was a BBC engineer and he covered the technical side, while Pat Gowen G3IOR taught the Morse. We had one evening a week from August until the following May to cover the complete syllabus, and Bill, being a BBC engineer, was very thorough. We also had fun doing it, with some mock examinations and lots of coffee, tea, and biscuits. We used to end the evening by getting into Bill's shack, where he would have a few QSOs.

Photo A. A lifetime in the shack has been very rewarding for G3LDI.

I passed both the technical and Morse examinations and was a very proud teenager to sport a new G3 license at the radio club. Then the hard work began. I had to build my own equipment, as nothing could be bought with the exception of a communications receiver, as they were called. I left school and obtained a job ,and within three years I had sold my

R1155 receiver and bought my own AR88D. I was over the moon with this, and then set to work building the Elizabethan transmitter. It was in a six-foot rack, all valves of course, and ended up in a pair of 807s modulated by a pair of 807s. Other rigs followed, and several years later I built an SSB rig and also began helping other newcomers by teaching Morse.

The magic — if it can be called that — has stayed with me throughout the years, but it was only because I knew what I wanted to do, and that was communicate with other like-minded people. Unfortunately, the modern generation does not seem to either view the hobby or even enter the hobby in the same manner. I have seen lots of them who think they wish to be an amateur, but do not want to devote the time and effort to study the theory and Morse in order to become licensed.

Amateur radio is a potpourri of all sorts of people, but mostly with a common denominator of a basic technical skill, good operating procedure, and the ability and willingness to help others. In other words, adherence to the amateur code, as printed in the front of all *ARRL Handbooks*.

If the amateur license is too easy to obtain, it will not be valued. This is the premise on which we should work, not the other way around. If something is worth having, it is worth putting a lot of effort into getting. This is what my father taught me, and it should stand today.

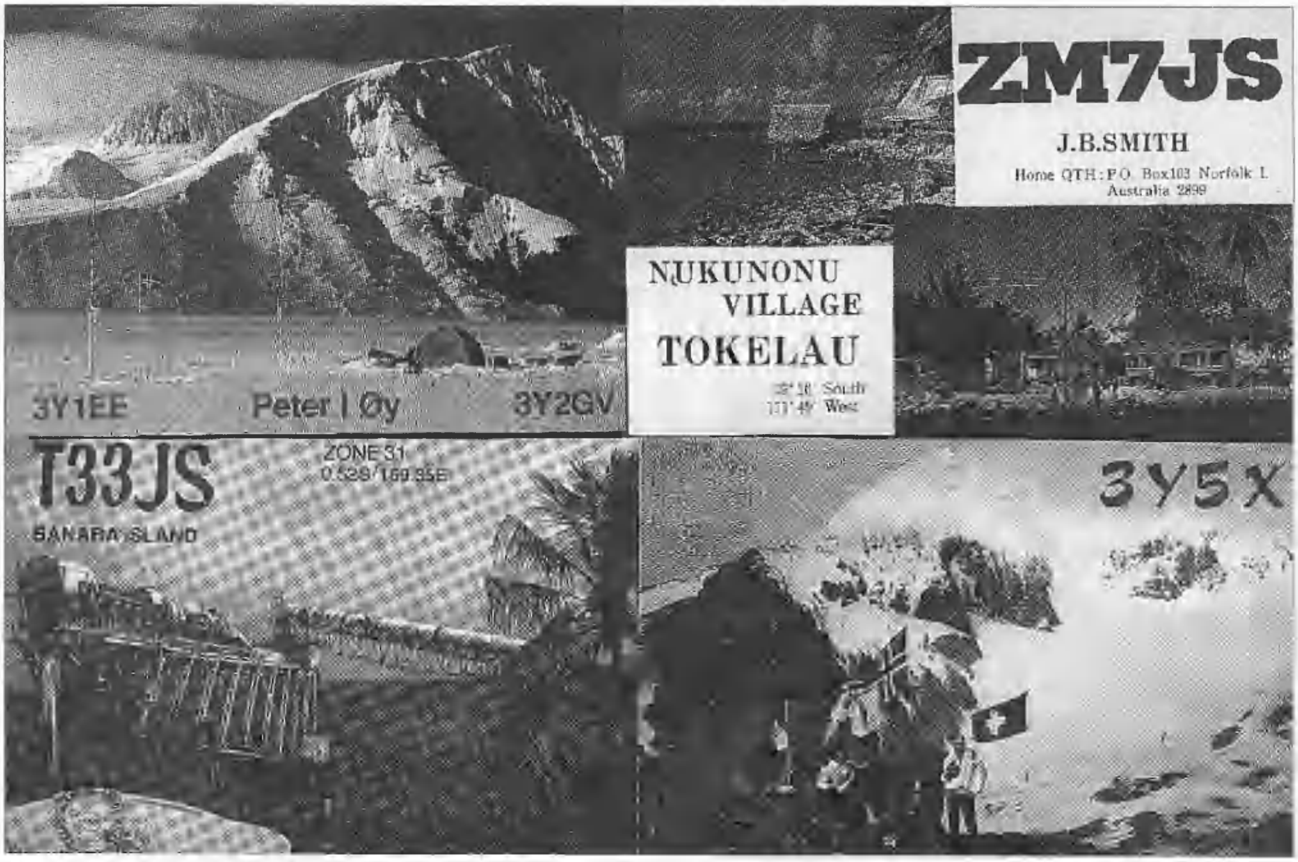
However, having just said all this, it can be debated until the cows come home. The fact is that the number of active amateurs is dropping. This is probably to be expected with the advent of modern technology, plus the inevitable silent keys, of course. The mobile WAP phone, the Internet, the PC and all that it entails, have all taken their toll on the hobby. We therefore have to try to attract the newcomer in other ways. We have to show the advantages of being within the hobby. Emphasis must be placed on the social side, club meetings, Field Days, contests, and so on, plus the operating awards that are available, QSL cards, and so on.

Using the Internet is fine, but there are no QSL cards or awards to be had by using E-mail, nor is the basic satisfaction of having communication by radio.

With amateur radio, you can chat, for as long as propagation will allow, with somebody in Australia, in fact to lots of people in Australia, or in just about any country in the world.

We should be promoting this sort of thing, with talks at schools and colleges. We should arrange a demonstration station at certain public events, with a display of QSL cards and awards, encouraging the contact to talk about his locality, his geography, his work, and so on. A display of QSL cards such as those seen here will help. The modern QSL card usually contains pictures and information about the place visited, and a comprehensive geographical knowledge can be built up over the years in this way.

One of the most satisfying aspects of the hobby is the fact that lifetime



friendships can be formed with amateurs in other countries through regular skeds. This can lead to visits and holidays with each other, something that could not possibly happen without the hobby.

I suppose I am living in a dream world, as several of the large national radio societies are advocating the 5 wpm Morse test, with a view to abolishing it altogether. They are also advocating making the technical knowledge required such that all the prospective candidate will be asked to show is that he can put a mains plug on correctly. To my mind this is not good for our hobby. Whilst I can understand the arguments that suggest this is the way forward, I do not agree with them. It is extremely difficult to reconcile the differences, but making it easy will not bring back the magic. There again, I suppose the magic is all in my mind, and not shared by many these days. Perhaps it was something that was peculiar to my generation of amateur, and trying to rekindle it will not work.

I am concerned that we might be on a downward spiral that is difficult to reverse. E-mails are so easy and fast, and this is the way that modern youth thinks. This is called progress, but it is a shame that this progress comes at a price, and if we are not careful, that price could be our frequency spectrum. Commercial interest in some of our bands is certainly there, and some frequencies have already been lost in certain parts of the world. If governments can see an easy buck to be made, I don't think a few amateur radio protesters would get in their way! We have already seen the selling-off in the UK of frequencies that can be used by the modern technology, WAP phones, satellite navigation, and so on.

I have valued my license and my hobby over the 45 years I have been involved. Making it easier to obtain will devalue it and might even lead to further erosion of the amateur population. Most of those who had to put lots of effort into obtaining a license seem to remain active and interested. They also have the added advantage of being

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Read All About It!

Part 7 of good stuff from The Hertzian Herald.

All about Radio bug bites boy, part 2; Don't ever do that!; and Computer trivia.

The word "crowded" does not even begin to describe the condition of the 40-meter Novice band in 1958, when I got my license. The only thing that approaches it today is Field Day or Sweepstakes — but, of course, the CW was slower. I did a little survey of my Novice-days' QSLs: two thirds of us were using receivers without crystal filters. The bandwidth was about 6 kHz, so we usually heard at least six stations at once. A common challenge was to set the dial at random and see who could copy three different stations without touching the dial — just by concentration.

In 1958, about 70% of us were using transmitters built from kits, 20% had home-brews, and 10% had commercially built rigs. If you could copy a signal report, a name, and a state before the QRM clobbered the guy, it was a good QSO. Postcards were 2 cents (until August, when they went to 3 cents), and if you could get a city and an address through so you could exchange QSLs, it was a cause for celebration. If you couldn't get it through, you had to wait until your call appeared in the next year's *Callbook* to get your QSL — no Internet callsign servers then.

Well, I put out CQs for about ten minutes that first night, and was lucky enough to copy KN9JSK coming back. It took ten minutes to get his state and a signal report (489) through the QRM — then he was buried in it. (I still have the QSL from that first contact — it's displayed in the top left slot on my bulletin board.) I called a few stations and sent a few more CQs, but heard no more replies. Then it was ten o'clock and QRT — school night, you know.

The next day I got on right after school and found the band somewhat less crowded. I had a 50-minute ragchew with Wisconsin, and then worked North Carolina. In a month, I had worked 14 states, as far out as Texas. During the next summer break I once got up at 4:30 a.m. to get away from the QRM, and worked Oregon — the West Coast at last!

How can someone of today's generation understand what direct communication over such distances meant to a 14-year-old in 1958? I had never been outside the states of Ohio and Michigan. This was way before cell phones and the Internet. It was before direct-distance dialing and satellite relay — *Sputnik* had gone up less than a year before. I remember Dad with his hand over the mouthpiece of the phone saying, "It's long distance," and Mom replying as a matter of course, "Who died?" In those days, long-distance calls were for emergencies only.

That autumn, I got my General ticket and began knocking off states toward my WAS on 20 meters. (I remember my civics teacher's astonishment when I filled in a map with the name of every state in about five minutes: It was a snap — I had worked most of them.) Soon after, I started working a little DX on 15 meters. Any DX was rare then, and pileups for the DX stations were awesome. It was only 13 years after the devastation of WW II in Europe, and I suppose those folks were still struggling for basic necessities, with little time or money left over for hobbies.

In January, I hooked up the output of an old two-watt phonograph amplifier to the screen-grid of the 6DQ6 final of my DX-20 transmitter and went AM with 32 watts input. (Transmitters were never rated by RF output then.) I had run into a number of local teenage

Reprinted with permission from *The Hertzian Herald,* newsletter of the Monroe County (MI) Radio Communications Association (MCRCA).

hams by then, and we began congregating on 75-meter phone every day after school — the Teen Net of Toledo, we called it. We formed our own teenage radio club, with perhaps 30 members. Meetings rotated around to members' shacks, and we put on some spectacular Field Day performances.

I'd say it was ham heaven, although I didn't realize it at the time, and I'd give anything to be 15 again, climbing a tree to secure the end of a Field Day antenna at Side Cut Park.

Don't ever do that!

Hello, fellow hamsters. Here's a grab bag of tips NOT to do, if you want to avoid trouble. Most of these I have seen hapless students do. A few I have done myself — once.

1. Never mark a printed-circuit board with a pencil. Pencil lead — actually graphite, a form of carbon — is conductive.

2. Never scrub a PC board with steel wool. Tiny steel fibers may lodge in the copper, shorting traces together.

3. Never pull a component out of a hot PC pad. The glue that holds the copper to the board is soft when hot, and you'll pull up the pad. Clean, straighten, clear, or cut until the component practically falls out.

4. Never file the tip of a temperature-regulated soldering pencil. You'll file off the iron plating that keeps it from corroding. Pure copper tips, used on inexpensive soldering pencils, need to be filed into shape and tinned regularly.

5. Never solder anything that is above your head or face. I got a hot blob of solder dropped on my chin once this way. (Good thing my mouth wasn't open.)

6. Never press down on springy wires while soldering. If they spring up, they'll throw solder in your face. Put the pencil under the wires, and press up lightly.

7. Never let a wire end point at anyone's face when cutting it with a clipper. The wire end will fly. Point it down at the floor.

8. Never connect or splice wires by simply twisting them together. The connection WILL go bad at some time. Solder it, bolt it, or use approved wire nuts or crimp fixtures.

9. Never saw at the insulation with a knife when stripping a wire. Roll the wire across the knife blade to avoid nicking the wire.

10. Never use tape as a permanent fixture. It will come loose with time. Use heat-shrink tubing, binding posts, or approved crimp splices, but don't tape.

11. Never measure a meter's coil resistance with an ohmmeter. Their test currents can be as high as 100 mA. You can imagine what such a current would do to a 100-μA meter.

12. Never connect a multimeter across a voltage source without double-checking to see that it hasn't gotten itself on the milliamps or ohms ranges somehow.

13. Never make changes in the hardware or software of an instrument without stapling a copy of the change documentation to the user's manual. I put another copy inside the instrument.

14. Never write anything on a piece

of paper until you have put a name, date, and title on it.

15. Never use an adapter plug or a 2-wire extension cord to defeat the 3-wire safety ground on an appliance cord.

16. Never work on a construction site unless the electric power is supplied through GFIs (ground fault interrupters).

17. Never extend an existing 2-wire 110-V circuit to a new 3-wire outlet using the existing neutral as the new "ground." The new ground must go all the way back to the service entrance. Violating this rule will place the case of a 3-wire appliance at 110 V in the event of a break in the neutral line.

18. Never charge a car battery in an enclosed area. Charging produces explosive hydrogen gas. Even if it's -5 degrees outside, open that garage door!

19. Never store a car battery on a cold garage floor. Temperature differences between the floor and the air cause internal currents which discharge the battery. Put it on an insulating sheet of Styrofoam.

20. Never wear a ring or a watch while working around 12-V auto or high-voltage circuits. I think the dangers here are obvious.

Computer trivia

MEGACHIP. One of the most common questions that an electronics engineer hears from casual acquaintances is, "How is it possible to cram several millions of transistors on an integrated circuit chip the size of your thumbnail?" Of course, a complete understanding of the physics, chemistry, and optics involved is beyond most people's reach, including my own. But some notion of how it is possible might be obtained like this:

Let's say it's 1961, and Michigan Instruments, a maker of silicon transistors, has just given you a million dollars, and told you that, by the end of the year, you are to have two transistors interconnected on a single piece of silicon. Do you think you could do it? With a million bucks and the resources of a company that was already proficient in making single transistors behind you, I think you could.

Then imagine that in 1962 they gave you $2 million and asked you to integrate three transistors by the end of that year. And suppose that this continued, with the company adding a million dollars to their payment and expecting a 50% increase in the number of transistors on the chip each year. I don't think that you would find the task impossible at any point, but by 1999 you would be putting ten million transistors on a chip. Do the arithmetic: on your calculator, it's 2 x 1.5 to the 38th power.

We didn't leap to megachips overnight. It's a case of a new technology illustrating some old proverbs. Ben Franklin phrased it as: "By diligence and patience the mouse chewed the cable in two." And long before that, the Chinese said, "A journey of a thousand leagues begins with a single step."

BOOT IT. We don't switch our computers on; we "boot them up." Is that because they're like a lazy dog, that has to be kicked to get it going? No, the term has nothing to do with "giving it the boot." The original term was "bootstrap," and referred to the finger straps at the tops of some boots that help you pull them on. If a child is wearing such boots, an adult can pick the child up by the bootstraps. A common joke was to tell a child to pick himself up by his own bootstraps. The phrase became a metaphor for an impossible startup situation. For example, you need a job to get money to buy a car, but you need a car first to be able to drive to the job.

Early computers had to "pick themselves up by their own bootstraps." As they came from the factory they had no stored program in them at all, so they didn't even know how to read their own keyboards or tape readers. Once the tape-reader program was in, other programs could be loaded easily from tape, but how do you get that first program in?

In 1971 I worked with a PDP-8 minicomputer. Starting it up was called bootstrapping, and it began by setting 12 binary address switches and 8 binary data switches and poking a load button.

This was repeated about a dozen times to enter a short program which told the computer how to read its tape reader.

Another program (on paper tape) was then loaded, which instructed the machine how to access its keyboard and printer, and how to run BASIC or assembly-language programs.

Today's computers have BIOS (Basic Input-Output System) programs in nonvolatile ROM, so they are ready to access their disk drives and keyboards without a lot of switch flipping, but the term "boot" remains as a reminder of earlier days. Now you know!

By Eric Shalkhausser W9CI, SK

The History of Ham Radio

Part 6: Across the Atlantic.

In the winter of 1920–1921, radio amateurs were openly dreaming about beaming radio signals across the Atlantic Ocean. However, their plans were not very well organized, and attempts during February, 1921, resulted in failure. No signals were heard, although many British stations were listening intently.

The effort prompted the operating department of the American Radio Relay League to make a renewed attempt. This time, to eliminate confusion and unnecessary QRM, a contest was planned and executed to select the stations within the American continent whose signals had the capability to cover the long distance. Applicants were required to first fill out a prescribed form.

The renewed attempt was planned for the period of December 7-16, 1921. Test transmissions were to start at 7 p.m. and continue uninterrupted until 1 a.m. EST. Each amateur radio district was to alternate, using a 15-minute time period, in making transmissions.

Phillip R. Coursey of London, editor of *Wireless World,* who was also instrumental in arranging the prior effort during the previous February, was in complete charge of all receiving stations in England and the other countries in Europe. All correspondence was routed through him. To assist and supplement the efforts of the British amateurs in coping with the problems (and there were many) of reception of American signals, the ARRL traffic department decided to have an American amateur sent to England to make sure that the most desirable and effective means were employed to insure success of the venture. Paul F. Godley, a native of Montclair NJ, who was a seasoned amateur radio operator and well versed in the use of shortwave equipment, agreed to undertake the assignment. Mr. Godley had adapted the Armstrong regenerative circuit to shortwave work.

So Godley and the equipment which he selected to take with him, along with the British and their receivers, made the undertaking an all-amateur project with everybody participating. With this in mind, the ARRL traffic department set up the following overall schedule: Six hours each night, for ten successive nights, signals were to be beamed in the direction of England and Europe. The French and the Dutch, as well as all other amateurs, were intensely interested in what was being attempted. From 7 to 9:30 p.m., a free-for-all schedule was to be followed. This two and one-half hour period was divided into ten sections of fifteen minutes each. During each section, all amateurs in a given amateur radio district would transmit. This would enable all amateur stations to take part. This part of the program was designed to open up the ether routes, one way or another, hoping that someone would get through.

The second and major period of each of the ten nights, from 9:30 p.m. to 1 a.m., was arranged exclusively for those qualifying amateur stations with the long-distance records. They were asked to beam their signals according to a prescribed selective schedule which was given to them by the operating department and kept secret until the day of transmission. Each station in the contest, free-for-all and selective, would initiate a call addressed to TEST, calling three times and signing three times, repeating this as often as desired during the periods assigned to

Reprinted from *73 Amateur Radio,* October 1978, where this was originally reprinted from QCC News, a publication of the Chicago Area Chapter of the QCWA. Photos were taken from the 1BCG commemorative issue of the Proceedings of the Radio Club of America, Inc., *The Story of the First Trans-Atlantic Short Wave Message,* October, 1950.

the district. For example: TEST TEST TEST de 1BGD 1BDG 1BDG (repeated).

Godley would keep an accurate log of all signals heard and have witnesses to monitor all records kept. After each night of the tests, the results would be given to one of the British longwave stations and the results of the previous amateur transmissions relayed to the listeners in America. In this way, every amateur in the United States and Canada would immediately be informed of the outcome of their endeavors. Commercial station MUU at Carnarvon, on a wavelength of 14,000 meters with plenty of power, could be copied anywhere on the American side As a special concession and because of the great interest that commercial companies took in these tests, the daily messages given by Godley to MUU were repeated by WII, the RCA station in New Brunswick, by slow Morse code, in order to let amateurs everywhere copy direct. This was done at 7 a.m. GMT, and everybody knew within hours how well many were doing. A summation of the entire undertaking is to be found narrated in the January and February, 1922, issues of QST, with both Godley and Coursey reporting in detail.

Many of the English amateurs, as well as some French and other stations, reported copying American signals. According to Godley, 22 CW and 6 spark stations were heard. The stations who made the grade are listed in **Table 1**.

Godley had set up his receiving station in Ardrossan, a small fishing village twenty miles to the west of Glasgow, Scotland. He chose this location in northern England rather than a location near London, knowing that the previous effort had gone astray primarily because of regenerative receivers used in early 1921 causing a great deal of heterodyne interference.

To the credit of a group of American amateurs determined to make a success of the opportunity offered, a station was built from the ground up, starting on November 19, 1921. Shortly after, Godley departed for England on December 15 on the *Aquitania*, with the parting words to his well-wishers, "Please build a station that will get over there."

Six amateurs pooled their enthusiasm and assembled a station using the latest techniques known, with the most advanced pieces of equipment available. They constructed an aerial system considered to be the best layout in theory and design for 200 meter radiation. The station was located in Greenwich CT, licensed 1BCG, the call of Mr. Cronkhite, who was one of the six.

The transmitter was initially put in operation on December 6, 1921. To inspect its performance, an agreed-upon long CQ was started on December 7th at 3:30 a.m. that lasted until 4:30 a.m. This was the first day of the transatlantic tests. From the records of the log kept by Godley, these first signals were not heard. The log kept by Godley between the 8th and the 16th, monitored and checked by a Mr. Pearson, an observer, had the following statements repeated very often:

"Weather wet and boisterous, find atmospherics very heavy—harmonics jamming reception—reception conditions very sporadic—having to fight heavy static continuously—the interference from many stations is almost constant ..."

It is interesting to read about these adverse conditions under

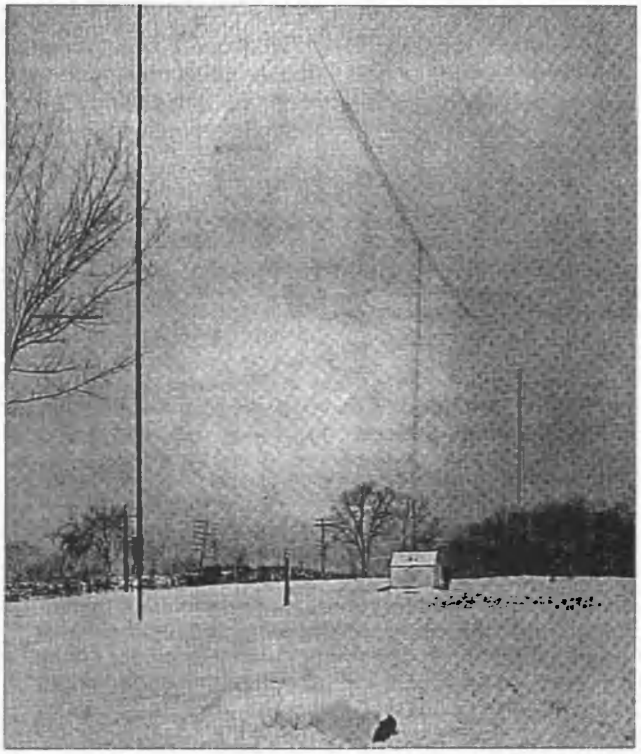


***Photo A.** General view of 1BCG showing the station building, the masts, and the antenna system. The mast to the right is 100 feet high, the one at the left is 80 feet. The antenna is of the so-called cage type, T-shape, a new form of aerial construction, at the time, which was especially effective in continuous wave transmission because of its uniformity. The flattop section of this antenna is 100 feet long, and its down lead is placed in the exact center and is about 80 feet long. Instead of a ground connection, a counterpoise forms the other part of the radiating system. The counterpoise is simply a secondary antenna system located a certain distance below the actual antenna and a certain distance above the ground.*

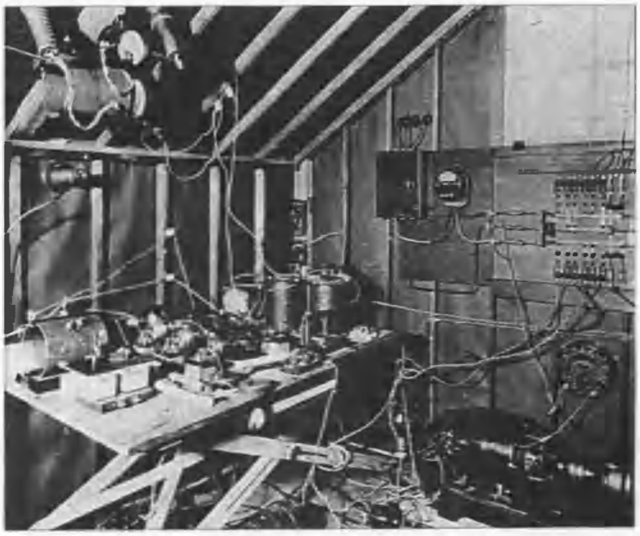
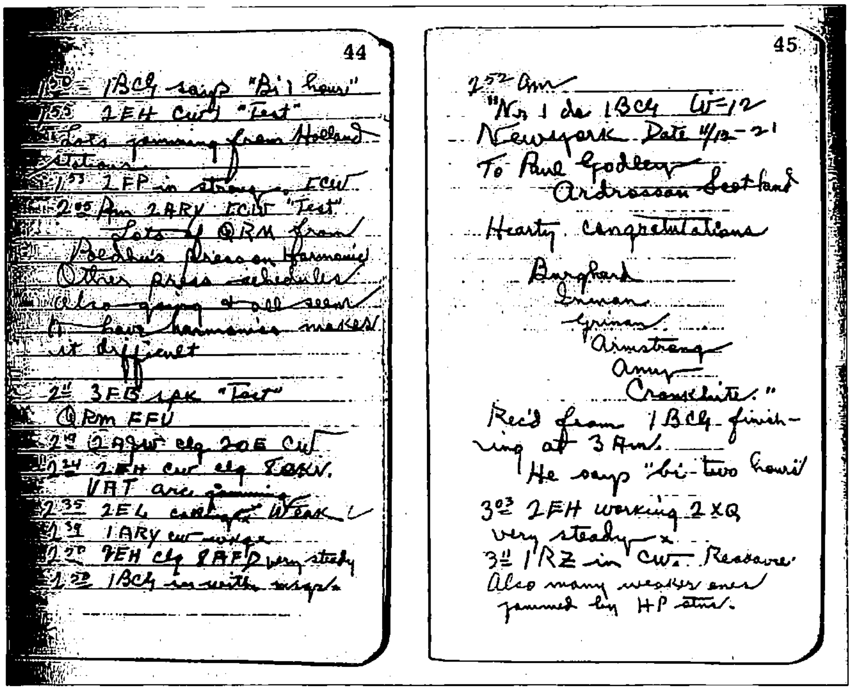


***Photo B.** Interior view of the station.*


44

45

2:52 Am

"Nr 1 de 1BCG W-12

Newyork Date 11/12-21

To Paul Godley

Ardrossan Scotland

Hearty congratulations

Burghard

Inman

Grinan

Armstrong

Amy

Cronkhite."

Rec'd from 1BCG finishing at 3 Am.

He says "bi-two hour"

3:03 2EH working 2XQ very steady

3:1 1RZ in CW. Reasonable.

Also many weaker ones jammed by HP stns.

Photo C. The first message. This is a facsimile of pages 44 and 45 from the original log kept by Paul Godley in Ardrossan, Scotland, showing the now famous "Nr. 1" as he copied it from station 1BCG at 2:52 a.m. GMT on December 12, 1921. This 12-word message was the first ever to be sent across the Atlantic on shortwaves.

Call	Place	Type	Wave	Cypher
1AFV	Salem MA	CW	200	YLPMV
1TS	Bristol CT	CW	200	AOTRB
1RU	W. Hartford CT	CW	200	BPUSC
1DA	Manchester MA	CW	200	CQVTD
1AW	Hartford CT	Spk	210	DRWUF
1BCG	Greenwich CT	CW	230	GODLY
2BML	Riverhead NY	CW	200	FSXVG
2FD	New York NY	CW	200	GTYWH
2FP	Brooklyn NY	CW	200	HUZXJ
2OM	Ridgewood NJ	Spk	200	JVAYK
2EL	Freeport NY	CW	200	KWBZL
3DH	Princeton NJ	CW	210	LXCAM
4GL	Savannah GA	CW	200	MYDBN
3BP	Newmarket ON	Spk	200	NZFCO
8DR	Pittsburgh PA	CW	200	OAGDP
9KO	St. Louis MO	Spk	200	PBHFQ
9AW	Toronto ON	CW	200	QCJGR
1ZE	Marion MA	CW	375	RDKHS
2ZL	Valley Stream NY	CW	325	TGMKU
3ZO	Parkesburg PA	CW	360	UHNLV
5ZZ	Blackwell OK	Spk	375	VJOMW
6XH	Stanford U. CA	CW	375	WKPNX
7ZG	Bear Creek MT	Spk	375	XLQOY
8XK	Pittsburgh PA	CW	375	YMRPZ
9ZY	Lacrosse WI	CW	260	RZQMY
9ZN	Chicago IL	Spk	375	ZNSQA
9XI	Minneapolis MN	CW	300	SFLJT

Table 1. First Transatlantic stations.

which Godley and his observer had to operate. Their receiving equipment was located in a large tent out in an open field near the seashore. The wind, rain, mist, and chilling breezes made the situation very unpleasant. Since it was December, the temperature was usually in the 30s, and they had no heat except a small oil stove. Keeping constant vigil was a trial, a severe test of endurance.

The receiving antenna was a 1300-foot longwire Beverage. It was strung up on ten twelve-foot-long wooden poles, not too firmly set into soft soil (which was covered with seaweed and very slippery to walk on). The cold rain and heavy squalls gave the men what came naturally under such conditions — a heavy cold and near pneumonia. As Godley aptly logged the situation, "A continuous fight against static and harmonic and cold and wet that drove one almost crazy."

The receiving equipment consisted of a Paragon regenerative receiver, together with a type DA-2 detector amplifier and a super-heterodyne receiver using ten tubes, a resistance-coupled amplifier, and an external beat oscillator. This equipment was chosen as being the best possible for both sensitivity and selectivity. Godley's aim in his receiver selection was to find an answer to the secrets of the Armstrong regenerative circuit, especially when reception of CW versus damped waves was concerned. This was a problem, one of the major ones, in the early 1920s.

Then, on the night of December 11, the signals from 1BCG came booming through with clarity and volume over much QRN and other interference. The message was logged by Paul Godley:

"Nr 1 de 1BCG words 12. New York, December 11, 1921: to Paul Godley, Ardrossan, Scotland. Hearty congratulations. Burghard, Inman, Grinan, Armstrong, Amy, Cronkhite."

The story on the success of 1BCG in all of its details may be found in a booklet entitled The *Story of the First Trans-Atlantic Short Wave Message*, published by the Radio Club of America, Inc. The message transmitted on the night of December 11, 1921, and acknowledged by cable to the ARRL headquarters by Godley was the first message to cross the Atlantic by shortwave amateur radio.

Now that this endeavor was successfully accomplished, an amateur fraternity grew in spite of amateurs being relegated to the short wavelengths of 200 meters, where it was considered impossible to carry messages to any great distances with a power input not to exceed 1000 watts. The event

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Radio News for February, 1922 697

Amateurs Span the Atlantic

As reported by PIERRE BOUCHERON

Above is the Transmitter at 1BCG. It Consists of Four 250-Watt Tubes Hooked up as Shown by the Diagram on This Page. The Radiation in the Aerials Was About Six Amperes.

The Long and Short Wave Receivers and Amplifier of 1BCG Hooked up to a Special Aerial. This Set Was Especially Used to Listen to the Messages From Mr. P. F. Godley. Sent by MOU Everyday.

THE Continuous Wave method of transmission has conclusively won its laurels for twenty (20) of the twenty - five (25) identified

The first amateur radiogram to be sent from the United States and to be received in Scotland during the great test is as follows:

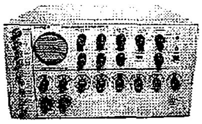
2EH—C.W.—Radio Engineers' Club, Riverhead, L. I.
2FD—C.W.—J. DiBlasi, New York, N. Y.

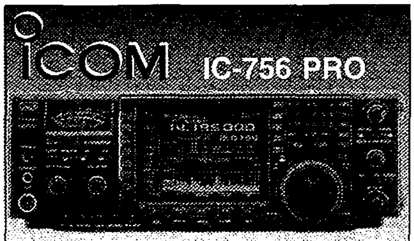
Photo D. *From the front page of the February 1922* Radio News. *Photos of Station 1BCG.*

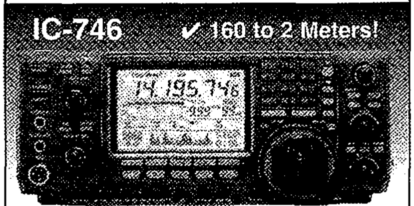
opened the door to bigger doings. The part played by amateurs, and exclusively by amateurs, in sending a message across the Atlantic with their simple homemade equipment was now recorded history. The distance covered was several thousand miles. Not until about 1926 were commercial circuits of a practical nature inaugurated on shortwaves, several years after amateurs had explored and demonstrated that the higher frequencies below 200 meters were feasible and practical and of real value in long-distance communication.

What happened in December, 1921, marked a turning point in radio history. What had appeared in books and been propounded in theory up to now, this "knowledge of the art," was now disproved. A new field of investigation was opened up for exploration. Through experiments, amateurs tackled the unknown ether bands and came up with answers.

In the next part, I will explore the part amateurs contributed to the early days of radio broadcasting. 73







Hugh Wells W6WTU
1411 18th St.
Manhattan Beach CA 90266-4025

Field Day 2000 with the Xerox ARC

Where every signal was — ahem! — *easy to copy?*

Field Day is an annual weekend of fun: staying up all night, no shaving, no shower for 24 hours, and usually all of the contacts you would ever hope to make.

The typical ham Field Day involves a lot of preparation and coordination in advance of the event. Of course, the objective is to set up and operate ham equipment in temporary locations, simulating an emergency situation.

To be different from past Field Day events and to return to the intent of the event, the XAR (Xerox Amateur Radio) Club in El Segundo CA decided to try something a little different, with the premise of responding to an unannounced emergency condition — in other words, emergency preparedness.

Was the club ready for an emergency?

Was the needed equipment available?

Were there trained operators available?

What was needed to set up quickly?

So, how do you find out? To answer the question, each member participating in the event was asked to arrive at the Field Day site with only the items/equipment carried to work on a normal day. **Photo A** shows the site immediately prior to the arrival of participants and the communications van.

Because of the emergency preparedness objective, the club elected to operate for only the first six hours of the normal 24-hour period allotted for Field Day. It was deemed more important to trade contact points for a test of preparedness and for weakness identification.

It was assumed that setting up on the low bands would provide the opportunity to communicate beyond

Photo A. The site immediately prior to the arrival of participants and the communications van.

Photo B. Equipment and operating positions set up inside the van.

Photo C. Chris KF6RSV, operating the solar powered station. The vertical antenna was taped to a camera tripod, creating a stable mount as well as a ground plane for the antenna.

Photo D. Dave AE6DR, John KM6JV, and George N6RVC were available as operators for the Field Day 2000 event.

the confines of a local/area disaster. The VHF and UHF bands would work well for local communication in time of need.

Equipment

One fortunate advantage afforded the XAR Club is the use of a mobile van housing most of the equipment required for ham operation. Both 12 VDC and 120 VAC of emergency power are available to run equipment. A 5 kW motor-generator, normally stored in one of the van's compartments, was moved away from the van to reduce the audible noise. Radio equipment belonging to the club and individual hams, is occasionally stored in the van or in the company ham shack located in one of the buildings. As a result, sufficient equipment was available within a short period of time for the Field Day exercise.

Not all of the available equipment was needed during the Field Day event, because the club elected to operate Class 2A. Fquipment for the 144, 220, and 450 MHz bands was also available, but was used only for club member communication and coordination. **Photo B** shows the equipment and operating positions that were set up within the van.

Operations

Operation was set up for both phone and CW on 40, 20, and 15 meters. In addition to the two low-band stations, a solar-powered 2-meter station was set up and operated. **Photo C** shows Chris KF6RSV operating the solar powered station. The vertical antenna was taped to a camera tripod, creating a stable mount as well as a ground plane for the antenna.

Photo D shows the three operators available for the Field Day 2000 event. They were Dave AE6DR, John KM6JV, and George N6RVC. Members available for the setup and teardown operations, shown in **Photo E**, were Art KD6JEG, Norm K6YPD, Hugh W6WTU, Johnny WB6HYR, and Chris KF6RSV. **Photo F** shows the antennas being unloaded and spread out for assembly, while **Photo G** shows them assembled and operating. **Photo H** shows the operators making contacts.

Setup

A three-element 10-15-20 meter beam, hooked to the rear of the van shown in the photos, is stored within the van when not in use. An all-band trapped vertical antenna can use the same mount where the beam is shown. For this Field Day event, a 40-meter

Photo E. Art KD6JEG, Norm K6YPD, Hugh W6WTU, Johnny WB6HYR, and Chris KF6RSV were available for setup and teardown operations.

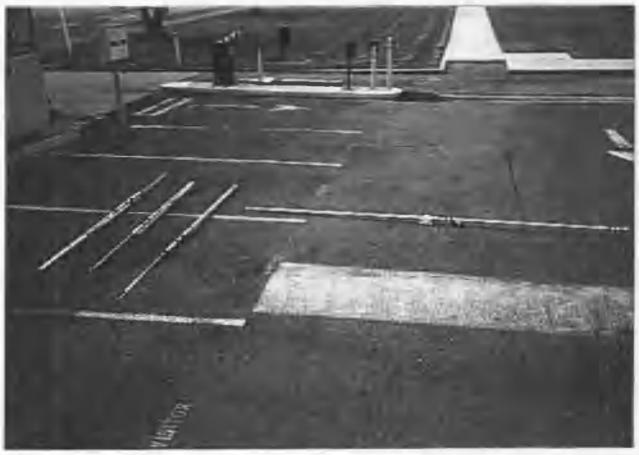


Photo F. The antennas being unloaded and spread out for assembly.

Photo G. These antennas are up and operating.

Photo H. Field Day contacts are in progress.

dipole was strung over the top of two Y-shaped parking lot light standards (**Photo I**).

VHF and UHF antennas can barely be seen along the upper roof line (driver's side) of the van. Each antenna is mounted with a hinge, allowing it to be flipped up for use, or lowered for storage.

Photo J shows the van at the end of the exercise and after everything had been packed up. The van was ready for return to its normal parking location.

Locations for a Field Day event are usually selected for height above the local terrain, a low electrical noise level, and a clear radiation pattern in a desired direction. However, such a desired location might not always be available during an emergency. XAR took that into consideration and elected to use the company parking lot, as it was assumed that in the case of an emergency, most club members would be on site and would break away from work to participate in emergency communications while staying on site.

During the Field Day 2000 event, the site electrical noise level ran in the 1–2 S-unit range, even though the antennas were in close proximity to power lines. Although the site was not ideal for a high contact point count, it was quite satisfactory for a "real" emergency situation. Making contacts outside of Los Angeles County was easy. Strong signals from Illinois and Indiana provided an excellent test of the parking lot location. A total of 182 contacts were made from coast to coast, including Canada.

Results

Yes, the club's objective of being able to set up and operate without extensive preparation was met using only the equipment stored within the van. Approximately two hours were required to get set up completely and to perform desired equipment testing.

Working with a limited number of tools did present a small hardship. The use of a Swiss Army knife, an adjustable end wrench, and a screwdriver saved the day.

Although no major issues were exposed, many strengths and weaknesses were identified. Lessons learned from the exercise boiled down simply to the following:

- Train club members to use all pieces of equipment.
- Set up and use equipment periodically.
- Mark antennas with band set marks for quick and easy assembly.
- Organize and inventory accessory

Continued on page 57

***Photo I.** A 40-meter dipole was strung over the top of two Y-shaped parking lot light standards.*

***Photo J.** Field Day 2000 is over, and everything has been packed up. The van is ready for return to its normal parking location.*

Dan Metzger K8JWR
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Lambertville MI 48144

Field Day Follies

Wherein some Yankee feds and some Zulus use an x-ray machine to bust up an old man's still — or something like that.

The only thing that saved me from death by boredom that June of 1962 was the fact that I had stumbled onto a local teenage radio club. I was 18, and my family was visiting relatives I didn't know in the foothills of Georgia. When the last Saturday of June arrived, I assured Mom once again that it was my civic duty to participate in the emergency preparedness exercise, and that I would be back Sunday around midafternoon.

The Field Day site was a sandy clearing in a state forest, apparently frequented by the Boy Scouts, for there was a fine, tall flagpole in the middle that was much sought after as an antenna support by the dozen of us who showed up. By early afternoon, we had climbed the necessary trees (and the flagpole), pitched the tents, and fired up the generator — when the army showed up.

It was a reserve unit — weekend warriors — on maneuvers. Along with jeeps and other vehicles, they had a thing that must have been the inspiration for today's monster trucks: BIG tires. They wanted to check it out in a sand pit at the edge of the clearing, so they had to ask us to move some guy wires.

While they were running it through the pit, a friendly argument broke out between the hams and the soldiers over whether that truck really could get through anything. The hams maintained that if somebody just dug a little depression at the edge of the pit, the thing would bottom out and get stuck. The only way to resolve the dispute was to try it, so a number of idle hams set to digging, while the troops left, promising to return Sunday morning and drive right through it.

As the evening's activities heated up, it became clear that a major rivalry was developing between the guys in my tent, working 40 meter CW, and the guys in Denny's tent, on 20 sideband. Denny was quite the showman, and had taped a pair of two-foot fluorescent tubes to the ends of his dipole. As it grew darker, it was quite an eerie sight to see those two blinking eyes, 30 feet apart and 40 feet in the air, against the black shapes of the trees. Rather brought Godzilla to mind.

Along with the darkness came the revelation that the road leading up to our clearing was something of a local lovers' lane, for we saw several cars pull to the side and turn out their lights, and we very much suspected that the people in them were doing that which their mothers had told them they must never do.

I guess it was about 11 o'clock when, feeling the call of nature, I began making my way a few feet into the woods behind Denny's tent. From somewhere in front of me I heard a car door shut, and someone with a heavy southern drawl said, "Get back in the front, and be ready to go." Behind me, Denny was running quite a pileup, picking off stations in their turn, and I heard a sidebander with a distinct New England twang say from the speaker, "I finally got you, old man. Whiskey Four X-ray Zulu Yankee this is ..." Then the generator coughed and died, and the woods went pitch black and strangely quiet.

I moved around uncertainly for a minute, for I was no longer perfectly sure which was the way back to the clearing. Then there was a rustling in front of me, and immediately I was confronted with the owner of the southern drawl.

"We'd better get out of here," he said. "I think it's the federals. They've got a big x-ray machine. I saw it flashing and snuck up and heard 'em talkin'. There's stills back in these woods, and they got an old man and his whiskey. There's Yankees and

Continued on page 57

This story originally appeared in *The Hertzian Herald*, newsletter of the Monroe County (MI) Radio Communications Association (MCRCA). It reportedly is fiction.

Parker R. Cope W2GOM/7
8040 E. Tranquil Blvd.
Prescott Valley AZ 86314

Radio Brat

A life in uniform has meant a world of contacts for this devoted op.

In 1951, retreads who were knowledgeable radio operators were welcomed by the Navy. Bill Jackson certainly fit the bill. Bill had joined the Signal Corps in 1941, served in the 112th Signal Radio Company, and become an accomplished radio operator. The ham bug hadn't bitten Bill, although he knew several hams at Camp Crowder MO, where he taught Morse code, radio procedures, and transmitters. The ham bug didn't bite until after his separation from the Army in 1945.

In 1947. he met Herb Evans W4LKT. now a silent key, who was his Elmer. Herb introduced the theory and practice of amateur radio. Bill was hooked.

Even with all of his radio experience, taking the FCC test in 1948 at the Federal Building in Miami FL was still a challenge. After a couple of tries he received his class B call, W4NFD.

Bill's first rig was an 813 amplifier in the top of an empty rack. After a lot of rework with Herb's generous help, Bill soon added to the rack a 2,000 volt power supply and a modulator consisting of a pair of 811s in class B. He was off and away. Eighty and forty meters were popular bands, but 20 meter CW was Bill's place of choice. Band changing was not achieved with the flip of a switch; plug in coils with link coupling was de rigueur. Load and tune, load and tune, and finally 250 watts. SWR meters were unheard of at the time, and tuning the impedance presented by the transmission line was an unavoidable activity. Being rockbound was almost an advantage.

The original antenna, 33 feet of #14 wire on a bamboo pole for 20 meters, was finally rounded out by a ten meter Workshop Beam by World Radio Labs. The old Hallicrafters S-40A receiver gave great service, but its stability left a lot to be desired; the wide IF was needed so that even when it drifted, the signal would still be in the bandpass. The sensitivity was pretty good for its day, but by today's standards it was nothing to write home about. Bill wasn't exactly a lid, but there was a lot he needed to learn about the world of ham radio.

The awesome propagation in the late '40s opened ten meters to all parts of the world. Bill found raising Europe almost as easy as bringing up today's local repeater. What a grand time to be a ham.

After leaving the Army in 1945, Bill joined the Naval Reserves in 1948, in the Naval Security Group as a third class petty officer. He was called up in 1951 during the Korean affair to begin a 22-year naval career. After a six-month cruise in the Mediterranean,

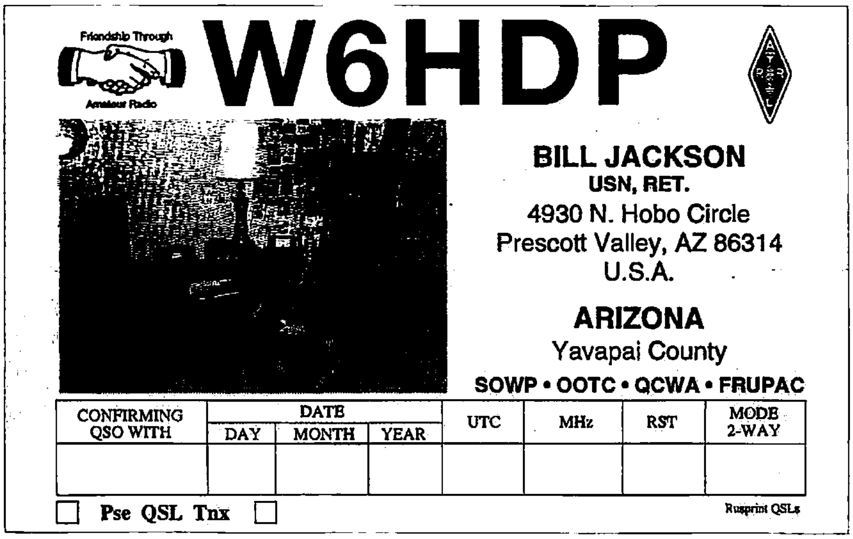

Fig. 1. Bill Jackson's QSL card.

he was stationed in Washington DC with the National Security Agency. Needing a ham station, he horse-traded for a Hammarlund Comet Pro and a Stancor 110-C transmitter. This and a dipole antenna put him in business on 80 and 75 meters, passing traffic on the Transcontinental CW net and acting as NCS on the Emergency Phone net with some participation in MARS (Military Affiliate Radio System).

In the early '50s, the MARS nets were just getting started, but most hams weren't participating. Petty Officer Jackson, along with six other hams, was summoned to a meeting at the Pentagon to see about resolving the problem. The meeting led to a system whereby hams who checked into the nets received points that they could use to buy surplus military radio equipment. A lot of this equipment was converted to operate on the ham bands as well as the MARS frequencies.

The flow of surplus military equipment after WWII was a godsend to the ham fraternity; state-of-the-art radio equipment for practically nothing was a boon not to be repeated. Of course, it did nothing good for the makers of amateur equipment, but hams reveled in it.

The Navy was not one to allow anyone to settle down for very long, so after three months of Navy school at San Diego in Signal Radio Intelligence, Bill was transferred to the Philippines for duty at Sangley Point.

At Sangley, a Chief Petty Officer was setting up a base MARS station. The restrictions on amateur radio operations at the time prevented Americans from operating in the ham bands. MARS was the next best thing. Obtaining an Air Force MARS license was in order, and Bill was given the call AI4GC.

Shortly after Bill arrived, the Chief working on setting up the MARS station was transferred to Collins Radio School, and Bill had to complete the job. Meanwhile, eight refurbished BC-610 transmitters had been shipped from Stockton CA. Of course, they weren't set to operate on the MARS frequencies, so Bill modified them. The MARS station finally got on the air and started making phone patches back to the States.

MARS was the only reasonable way for the Navy personnel on TDY (temporary duty) to talk with their families stateside. Many five minute phone patches were made through K6AF, at George AFB in Victorville CA. The patches to families back stateside were a great morale booster for the sailors and aviators. (Navy aviators aren't called pilots; pilots guide ships into and out of port.) The Sangley Naval Air Station was turned back to the Philippines after Bill's reassignment to Japan. The base station that was sweated over was not used after the base was returned to the Philippines.

Operating in Yokohama, Japan, as KA2WJ put Bill at the other end of the DX, and hamming was truly exciting. Ham operations were mainly restricted to the weekends, but many stateside contacts were made and QSLs sent, maybe adding a new country to someone's list.

Back in the States in Washington DC in 1958, ham radio for Bill took on a different look. He traded his BC-610 for a Viking I and a Heath DX-100. The Viking was an excellent AM transmitter with full plate modulation. With the SX-28, the station took on a nice polished look. The skywire was a cubical quad built for 10 and 15 meters. He logged 99 countries from there.

Again, the Navy couldn't let their personnel put down roots, and Bill was transferred to Cyprus. At first it seemed like another chance to be hunted DX. But it was not to be. The Cyprus communications department was totally disorganized and foreigners weren't able to get amateur operating privileges. There, ham radio took a turn for the worse for two years. Copying radio traffic kept his CW skills sharp, but quiet hours for two years were not a happy time for a ham.

Things came back to life for Bill in a transfer to Port Lyautey, Morocco. Licensed as CN8GC, Chief Jackson put the Heath DX-35 kit built in the Philippines and a Hammarlund-110 receiver to good use. Never quite satisfied, like most hams, he built a 10-15 meter quad and a 10-15-20 mini

Photo A. Bill Jackson and Barry Goldwater in 1990.

Photo B. W6HDP/7 today.

beam. He completed the station with a Knight T-150 transmitter. CN8GC was a sought-after contact.

Bill and his wife Ann came back to the States in 1964, to Key West FL. A Drake TR-4 and a Hustler antenna now allowed him to work SSB with the old call W4NFD. The Drake is still a revered piece of gear, but economics being what they are, Drake has been forced to abandon the amateur market.

After 22 years in the service, retirement was in order, and California beckoned Bill. A new callsign, W6HDP, and a new job as a computer electronic tech, permitted a Tempo One and later an Atlas 210-X mobile to grace his shack. Wanderlust struck, and the Jacksons RV'd around the country with the Atlas and Hustler antenna, until Bill and Ann migrated to Phoenix AZ in the '80s.

Bill gravitated to a Kenwood TS-180-S and a Dentron amplifier and tuner, and continued to pursue his love of amateur radio.

In March of '87 Bill assumed the directorship of the Southwest Chapter, SOWP (Society of Wireless Pioneers). As an active member of QCWA (Quarter Century Wireless Association), Bill helped arrange a joint 1988 holiday luncheon meeting between the Arizona QCWA chapter 16 and SW Chapter of SOWP. Leo Meyerson WØGFQ, founder of World Radio Labs, entertained the gathering with stories of his days playing piano and organ for silent movies, and of how he organized Wholesale Radio Labs in 1935, and after WWII, World Radio Labs.

Later meetings of QCWA and SOWP featured speakers like Barry Goldwater K7UGA, Dave Bell W6AQ, who produced the film "World of Amateur Radio," Dick Baldwin W1RU, past president of IARU, and Lew McCoy W1ICP, technical editor of *CQ* magazine.

The meetings were discontinued in 1998, when Bill resigned as Southwest director. Of course, ham radio wasn't a hot commodity either, but it struggled on. The magazines devoted to ham radio fell on hard times, and their number decreased to today's few.

During hurricane Andrew and the 1989 earthquake, Bill spent many hours as net control passing health and welfare traffic, thus fulfilling one of amateur radio's purposes

Bill believes the new FCC license restructuring will bring in new blood. While he is an avid CW practitioner, the cry "CW forever" is a lost cause here and around the world. But the joys of amateur radio can still be enjoyed by millions. CW may actually bloom again when newcomers realize CW need not cost an arm and a leg, and a CW QRP rig can be built for a fraction of the cost of a new SSB transceiver. CW may be an option that can't be ignored.

Chief Jackson was awarded two battle stars for landings in the Pacific, the Presidential Unit Citation for the initial landing on Luzon in the Philippines, and the pre–Pearl Harbor American Defense Medal.

Amateur radio has filled many pleasant hours for Bill and led to many long-lasting friendships. Precious memories that could have been made no other way were made through amateur radio. Bill still keeps in touch with his friends and shipmates on the FRUPAC (Fleet Radio Unit Pacific) net on 40 meters, and has schedules on 20 meters every Monday and Thursday. He is a very active ham who signs into 13 different nets on CW and phone. Bill is also a VE (Volunteer Examiner) with the Yavapai Amateur Radio Club in Prescott AZ.

Bill lives in Prescott Valley AZ with his wife Ann. His E-mail address is [w6hdp@primenet.com].

CALENDAR EVENTS

Listings are free of charge as space permits. Please send us your Caalendar Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the September issue, we should receive it by July 5. Provide a clear, concise summary of the essential details about your Calendar Event.

JUNE 2

SPRINGFIELD, IL The Sangamon Valley Radio Club Hamfest will be held at the Illinois State Fairgrounds Cooperative Extension Building in Springfield, rain or shine. From I-55 take Sangamon Ave. west to the Illinois State Fairgrounds. Stay on Sangamon Ave. past the main gate. Go to the next gate (Gate 11). Enter Gate 11 and drive straight back to the Cooperative Extension Building. Talk-in on 146.685 MHz(-.600). Tickets $5 each, or 3 for $10. No additional charge to set up in the 100,000 sq. foot covered flea market area. Limited indoor tables may be available. Contact *Ed Gaffney KA9ETP, 13977 Frazee Rd., Box 14A, Divernon IL 62530; tel. (217) 628-3697; or E-mail [egaffney@family-net.net]*. For more info about the Sangamon Valley RC, this hamfest, or obtaining an amateur radio license, please visit *[WWW.W9DUA.NET]*. This hamfest is co-sponsored by Shooting Stars 4-H. Food service provided by Shooting Stars 4-H.

JUNE 3

CHELSEA, MI The 23rd Annual Chelsea Swap, Ham and Antique Radio Swap, will be held on June 3rd in Chelsea MI, at the Chelsea Fairgrounds on Old US 12 at M-52 in Chelsea. Gates open at 6 a.m. for sellers; 8 a.m. for the public. Donation is $4 in advance, $5 at the door; under 12 free. Plenty of parking; easy access from I-94. Talk-in on 145.450(-), WD8IEL Chelsea rptr. Trunk sales $5 a space. Table space, $10 per 8-ft. table. Handicap access. For reservations and more info, E-mail *[WD8IEL@hotmail.com]*; or contact *Bill Altenberndt WB8HSN, 19501 Bush Rd., Chelsea MI 48118*. Sponsored by the Chelsea ARC, Inc.

MANASSAS, VA Virginia's Ole Fashioned Manassas Hamfest, amateur radio, computer and electronics show, will be presented by the Ole Virginia Hams ARC, Inc., at Prince William County Fairgrounds, 1/2 mile south of Manassas, on Rte. 234. Talk-in on 146.97(-), 224.660(-), and 442.200(+). General admission is $5 per person at the gate. No advance sale. Gates open at 7 a.m. Free parking. Indoor exhibitor space with 8-ft tables, $30 each with chairs and electricity. Tailgating $5 per space (plus admission), gates open at 6 a.m. Setups 2 p.m.–10 p.m. Saturday, June 2nd. Ample room for everyone. For VE exams, contact Ruth KU4WH, tel. (703) 331-1234; or E-mail [Frizzy2@aol.com]. Features: ARRL Roanoke Div. officers and 4th Call Area QSL Bureau reps will be present; DXCC QSL card checking; Virginia QSO Party Awards Ceremony. Food vendors must have prior written approval from the Hamfest Chairman. For dealer info, contact *Jack N4YIC, tel. (703) 335-9139; fax (703) 330-7987; E-mail [N4YIC@arrl.net] or [patnjack@erols.com]*. For general info, contact *Mary Lu KB4EFP, tel. (703) 369-2877, E-mail [mblasd1638@aol.com]*.

QUEENS, NY The Hall of Science ARC Hamfest will be held at the New York Hall of Science parking lot, Flushing Meadow Corona Pk., 47-01 111th St., Queens NY. Doors open for vendors to set up at 7:30 a.m. Buyers admitted at 9 a.m. Free parking. Food and refreshments available. VE exams at 10 a.m. Admission by donation, buyers $5, sellers $10 per space. Talk-in on 444.200 rptr., PL 136.5 and 146.52 simplex. For more info, call at night only, *Stephen Greenbaum WB2KDG, (718) 898-5599, E-mail [WB2KDG@Bigfoot.com; or Andy Borrok N2TZX, (718) 291-2561, E-mail [N2TZX@webspan.net]*. For VE exam info, contact *Lenny Menna W2LJM, (718) 323-3464, E-mail [LMenna6568@aol.com]*.

JUNE 10

BETHPAGE, NY The LIMARC Spring 2001 Electronics Hamfair and Flea Market will be held at Briarcliffe College, 1055 Stewart Ave., Bethpage NY, beginning at 8:30 a.m. Gates open at 7 a.m. for vendors. General admission is $6, children 12 and under accompanied by a paying parent, and non-ham sweethearts will be admitted free. For more info, visit the *LIMARC Web site at [http://www.iimarc.org], or call the 24-hour info line at (516) 520-9311*. Talk-in on the 146.850 rptr. PL 136.5. *E-mail [hamfest@limarc.org]*.

WHEATON, IL The Six Meter Club of Chicago, Inc., will hold its 44th Annual Hamfest, a ham radio and electronic flea market which also features antique and vintage radios. The event will take place Sunday, June 10th, at DuPage County Fairgrounds, 2015 Manchester Rd. (north of Roosevelt Rd. [Rte. 38], east of County Farm Rd.). This hamfest will be held rain or shine. ARRL and dealer displays. Free parking, no extra charge for space in outdoor flea market. Limited overnight RV parking with electrical hookup — $10 each by advance registration, required by May 25th. Advance tickets $5 each, $6 at the gate. Advance tickets available from *Joseph Gutwein WA9RIJ, 7109 Blackburn Ave., Downers Grove IL 60516*, or any club member. For info call the *24-hour InfoLine at (708) 442-4961*. General parking at the West Gate; sellers ONLY at the East Gate. Handicap parking, use East Gate. Gates open at 7 a.m., buildings open to the public at 8 a.m. Talk-in on K9ONA 146.52 or K9ONA/R 146.37/.97 (107.2). Commercial tables 8 ft. w/ 110V in main bldg., air cond., $12 before April 30th, $15 after. Indoor flea market tables, 8 ft., no electric, $10 before April 30th, $12 after. ARRL VE exams 9 a.m.–11 a.m.; call the InfoLine to pre-register for testing. Make check payable to *Six Meter Club of Chicago*, and send with SASE to *Six Meter Club of Chicago, 7109 Blackburn Ave., Downers Grove IL 60516*, no later than May 25th. Absolutely no alcoholic beverages permitted. All sellers are responsible for cleanup of their spaces. No sales of food or beverages permitted.

JUNE 16

DUNELLEN, NJ W2QW, The Raritan Valley Radio Club of Martinsville NJ, will hold a Hamfest at Columbia Park, near the intersection of Routes 529 and 28, 7 a.m.–2 p.m., June 16th. Sellers set up at 6 a.m. Admission: Buyers $5, sellers $10 ($5 each additional space). Talk-in on 146.625(r), 447.250(r), 447.250(r) tone 141.3, and 146.520 simplex. Contact *Doug Benner W2NJH, (732) 469-9009, [WB2NJH@AOL.COM); or Fred Werner KB2HZO, (732) 968-7789, before 8 p.m.*

JUNE 17

MONROE, MI The Monroe County Radio Communications Assn. will hold its annual "Monroe Hamfest" 7:30 a.m.–1 p.m., at the Monroe County Fairgrounds, 2 miles west of Monroe on M-50. Indoor tables $15 for first 8-ft. table and 1 ticket, $10 each additional table. Trunk sales $6 for 8-ft. space. Overnight camping $15. Free parking. Refreshments will be available. Talk-in on 146.72. Advance tickets $6, includes two stubs for drawing; $6 at the door, with one stub. Contact *Fred VanDaele*

Continued on page 40

Calendar Events

continued from page 39

KA8EBI, 4 Carl Dr., Monroe MI 48162. Call (734) 242-9487 after 5 p.m., or E-mail [ka8ebi@arrl.net].

JULY 4

BRESSLER, PA The Harrisburg Radio Amateur Club, W3UU, will hold its Firecracker Hamfest in celebration of its 29th year, at Emerick Cibort Park, Bressler PA. Set up on July 3rd from 6 p.m.–9 p.m., or July 4th at 6 a.m. The park opens to the general public at 8 a.m. July 4th. 80 covered tables, all with electricity, only $12 each, prepaid by June 1st. All tables paid for after July 1st will be $15 each, prepaid on a first come first served basis. 48 hour cancellation notice required for refunds. Contact *Pete deVolpi K3PD, 408 Hillside Ave., New Cumberland PA 17070. Weekday phone (717) 705-1370, weekends and evenings 6–9 p.m. (717) 938-8249. E-mail [w3uu@aol.com].* See the Web site at *[http://members.aol.com/w3uu/].*

JULY 7

OAK CREEK, WI The South Milwaukee ARC Inc. will hold its 33rd annual Swapfest on July 7th, at American Legion Post #434, 9327 S. Shepard Ave., Oak Creek WI. The event will run 6 a.m.–2 p.m. CDT. Free parking. Picnic area and limited overnight camping are available with plenty of nearby hotels/motels. Hot and cold beverages will be served. Admission is $5 for buyers or sellers. This includes a free "happy time." Talk-in on 146.52 simplex as well as on many of the local repeaters. A flyer with map may be obtained by writing to The *South Milwaukee Amateur Club, P.O. Box 222, South Milwaukee WI 53172-0102.*

JULY 15

WASHINGTON, MO The 39th Annual Zero Beaters ARC Hamfest will be held Sunday, July 15th, 6 a.m.–2 p.m., at Bemie E. Hillerman Park (Washington Fairgrounds). Free parking and free admission. Technical sessions, ham radio and computer flea market, ham radio demonstrations. Talk-in on 147.24(+) rptr. Watch for green on white hamfest signs. VE exam registration starts at 9 a.m. Walk-ins welcome, limit 60. Bring original license and a photo copy. For info SASE to *ZBARC VE Exam, P.O. Box 1305, Washington MO 63090.* For hamfest info, contact *Zero Beaters ARC, P.O. Box 1305, Washington MO 63090; 147.24(+) rptr.; Keith Wilson KØZH, (636) 629-2264, fax (636) 629-1196;* or *Bob Goza WØBOB, (573) 484-3718, [wØbob@arrl.net].* Check the Web site at *[www.yhti.net/~wØbob/zbarc].*

JULY 22

SUGAR GROVE, IL The Fox River Radio League will hold their Annual Hamfest at Waubonsee Community College, Rte 47 at Harter Rd., Sugar Grove IL (5 miles NW of Aurora). Doors open Sunday at 8 a.m. Set up Saturday at 7 p.m., Sunday 6 a.m.–8 a.m. VE exams at 10 a.m. Bring original license, copy of license, and photo ID. Talk-In on 147.210(+) PL 103.5/107.2. Contact *Maurice L. Schietecatte W9CEO, c/o FRRL, P.O. Box 673, Batavia IL 60510. Tel. (815) 786-2860, or E-mail to [w9ceo@arrl.net].* The Web site is at *[http://www.frrl.org/hamfest.html].*

JULY 27–28

OKLAHOMA CITY, OK The Central Oklahoma Radio Amateurs will sponsor "Ham Holiday 2001" at the Oklahoma State Fair Pk., northeast of the I-40 and I-44 intersection. This will be their 28th annual event. The event will be held in the Hobbies, Arts & Crafts/Modern Living Building. Doors open Friday, July 27, 5 p.m.–8 p.m.; Saturday, July 28, 8 a.m.–5 p.m. Features: Technical and non-technical programs, WAS card check, VE exams, flea market. Advance tickets $7, $9 at the door. Flea market tables $10 in advance, $15 at the door (if available). Electrical hookup $5. Talk-In on 146.82. Additional info and registration forms are available on the CORA Web site *[www.geocities.com/heartland/7332].* Address other inquiries to *Ham Holiday 2001, P.O. Box 850771, Yukon OK 73085-0771; or E-mail [corahams@swbell.net].*

JULY 28

CINCINNATI, OH The 4th Annual OH-KY-IN Amateur Radio Society Hamfest will be held July 28, 7 a.m.–1 p.m. at Diamond Oaks Career Development Campus, 6375 Harrison Ave., Cincinnati OH. This facility is located just east of I-275 and I-74. Take I-74 to the Rybolt Rd./Harrison Ave. exit (Exit #11). Go east on Harrison Ave. Diamond Oaks is located on the right (south side) of Harrison Ave., less than one mile from the I-74 exit. Special seminars, transmitter hunts, indoor vendors, outdoor flea market — first space free with admission ticket, additional spaces $3 each. VE exams at 8 a.m., walk-ins accepted. Free parking; handicapped parking available. Talk-In on 146.670(-) and 146.925(-) rptrs. Advance tickets $5, $6 at the gate. Age 12 and under admitted free. Indoor vendor tables (6-ft. with free electric) $10 each. Contact *Lynn Ernst WD8JAW, 10650 Aspen Place, Union KY 41091-7665, tel. (859) 657-6161; E-mail [wd8jaw@arrl.net].* Web site at *[www.qsl.net/k8sch].*

SPECIAL EVENTS, ETC.

JUNE 6–10

BEDFORD, VA Old Dominion Chapter #202 QCWA and other area clubs will operate Special Event station WW2DDM, commemorating the dedication of the National D-Day Memorial in Bedford. Operation will be 1700–2400Z June 6–June 10. Contacts can be made on 7.050, 7.250, 14.050, 14.240, 21.050, 21.330, 28.050, 28.350, 50.222 and 144.222. Send SASE for QSL or certificate, to *Charlie Beckwith K4BSF, 563 Buzzard Rock Ln., Rocky Mount VA 24151-4844 USA.* For additional info see the Web site at *[www.usit.net/~pob/qcwa].*

JUNE 30–JULY 2

DeSMET, SD The Huron ARC, and the Lake Area Radio Klub, will host a special events station to celebrate the 30th Anniversary of the "Little House on the Prairie" Pageant. They will be on the air 1600 UTC June 30–0200 UTC July 2. Frequencies: 7.265, 14.265, 21.365, 28.465 and 50.165. To get a certificate or a QSL card, write to Huron ARC, P.O. Box 205, Huron SD 57350; or Bill Kerker [Wa0tdk @arrl.net]. Tel. (605) 352-1577.

JULY 20–22

IRVING, TX Seven members of The Jim Smith Society will operate station W9JSS at the 31st annual Jim Smith convention, July 20, 21 and 22, in Irving TX. The society has about 225 FCC licensed members. Contact W9JSS and receive a unique QSL card — one name with seven different callsigns. Try 14.280, 21.380 or 28.380 +/- QRM, 1530Z–1730Z all three days. Requests for a QSO on other bands, or other times, can be sent to [JimW*B9UKK@aol.com].* For more info about The Jim Smith Society, check the Web site at *[www.jimsmith2.org].*

The Digital Port

Jack Heller KB7NO
P.O. Box 1792
Carson City NV 89702-1792
[jheller@sierra.net]

Join the Digital Revolution!

The message I see often on my monitor states a clear fact: "I haven't been this active in ham radio for years, I can't get enough of this digital stuff."

If there ever was a boon to the ham operator whose interests have waned, the digital revolution has provided it. I have conversed with many hams who have become suddenly ecstatic with these strange new computer-controlled (did I leave out inexpensive?) warbling modes that are so easy to get into and permit excellent worldwide radio communications with low power.

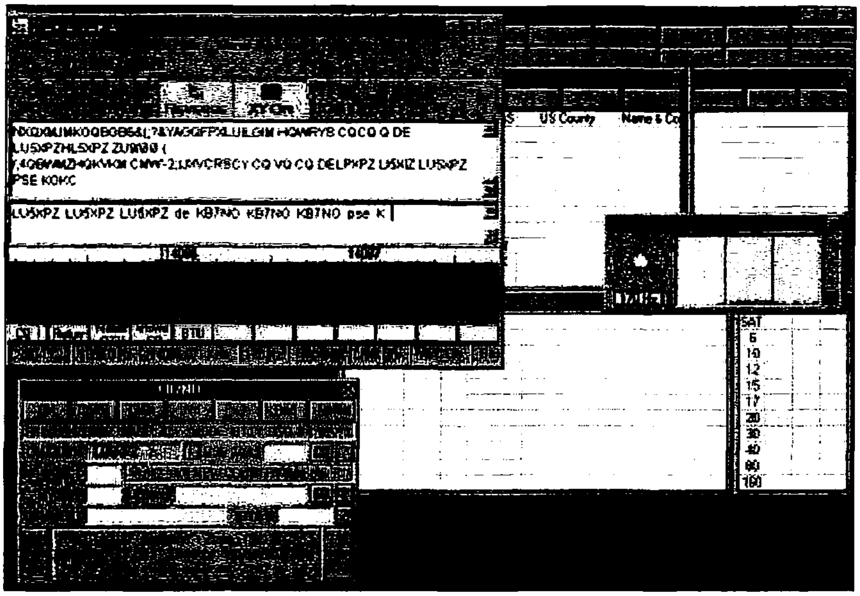

Fig. 1. Screenshot 1 — The MMTTY module included in Zakanaka is displayed at the upper left with Logger in the background. For those of us who are monitor challenged (15" diag.), this is a good arrangement and the software seems to be designed for this purpose. Logger displays the frequency from the rig which becomes the frequency at the left of the tuning pane. When you capture the other station's call it appears in the Logger entry pane and from that time is available for your macros. Capturing the name displays it in the Comments line and also is for use of your macros. Once you are finished entering the other station info you may, if you feel it necessary, maximize the communications panel and have full accessibility to all the controls. You may minimize the RTTY mode pane to the above size at any time to return to the layout as shown. Or you can pull and tug these panes around any way you wish for convenience; it is simply a Windows function. The little tuning window at the right has an oscilloscope display in it as well as the tuning capability. The two programs work hand-in-hand so the pertinent facts about the QSO are logged automatically as soon as you hit Enter. All the setup and tweaking available to MMTTY is available as well as setup with in the Zakanaka program. The documentation provided guides you through the whole process step by step. Nearly every default value and setting will be correct for you to get on the air immediately upon installation. You will mostly need to change settings that apply to your rig. Almost a plug-and-play operation. Very simple and straightforward. And FREE !

My beleaguered XYL, of course, simply puts these strange noises emanating from the shack as a further proof of my eccentricities. She is sure the house is much calmer when I unplug the speakers from the soundcard so she doesn't have to have her musically inclined hearing sensors "blasted" with the warbling.

She has a different description, not quite related to warbling, but we have a conflicting perspective as to which sounds are more pleasing. 'Nuff said — end of editorial. But the truth remains: Digital has caught on and is a resounding success, regardless of mode or software.

And ... some months, I feel the need to restrain myself from sending enough material to fill half this magazine. Poor Wayne wouldn't have room left for his famed editorials.

Well, enough of that. There is a lot going on out here in digital land. Last month, I gave you some info on a quickly evolving program for SSTV that is a freebie. The enthusiasm and the development process hasn't slowed since then.

I just downloaded the beta version .20 of MMSSTV. The upgrades are coming fast and furious these days. It seems it was only a month ago that we were using version .11 and, by the way, this runs on the 120 MHz CPU here but faster is recommended.

QRP digital

I was conversing with a QRP ham just the other day. One of those peculiar days when I heard no action on the 20 meter digital segment. I tuned haphazardly down to 14.063 and found the distinct fleep-tweep sound of Hellschreiber calling CQ. Quickly, I loaded the software and "caught Nick KCØBGA, before he got away."

Turned out, he was doing the final

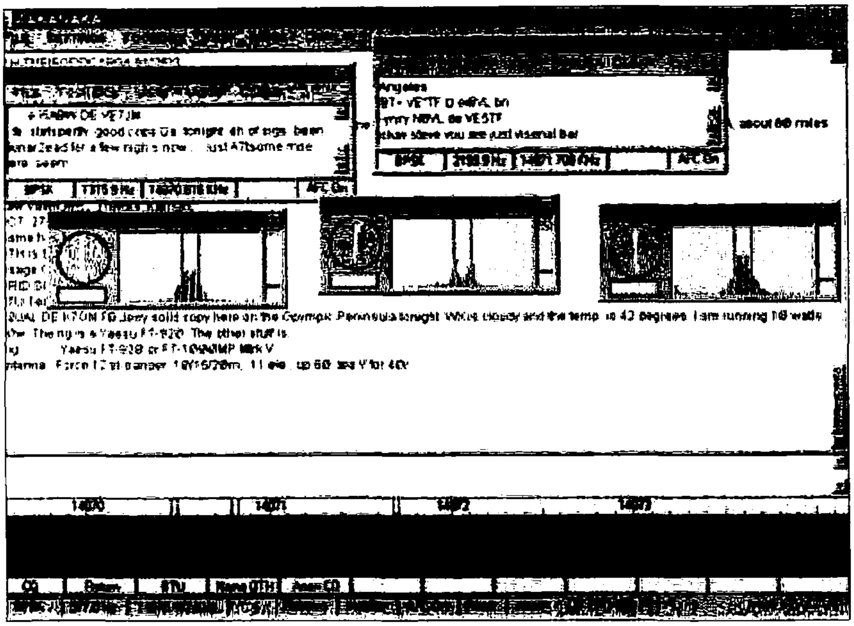

Fig. 2. Screenshot 2 — Zakanaka will very handily monitor three PSK31 signals at a time. In this example, you see the main large pane in the background with print being added below the auxiliary panes. The five smaller panes can be positioned anywhere you wish in regular Windows fashion. When you examine the actual display closely, you will see that the tuning windows are color-coded so you can tell which signal is in which pane. I found tuning the auxiliary signals was easily done by clicking within the tuning window. It went quickly and the software seemed to jump at the signal when it got close and tune perfectly. It would be possible to arrange this panel the same as the RTTY example so you could observe the Logger entry pane. You would need to use just the main receiving pane to avoid clutter. It is not necessary to have all this busy-ness. It is your choice to configure the way that works best for you. PSK31-transmitted signals are very sensitive to audio drive. Zakanaka's Help file covers this and the software makes it easy to perform the adjustments. Follow the instructions and you will not have complaints about a "wide splattering signal." The reports received were all very complimentary about the clean signal. You can choose the number of macros you wish to display. Plus, the RTTY module has its own set of macros so you can make them mode sensitive. And this is FREE software!

tweaking on the low power version of the Elecraft radio kit he had just assembled. It was doing a bang-up job, especially for 5 watts, and we were not employing anything other than the default Hell mode. I tried a little trick I had seen on the Hellschreiber reflector for curing light print. I clicked the AGC button and instantly, the print darkened on the monitor.

All went well, and the discussion turned to MT63. It had been a while since I had worked that mode, but the software is on the hard drive, so we went to 14.113 and Nick gave a call before I was finished poking the buttons. He had a terrific MT63 print on the monitor, again with the 5 watts.

Every time I work someone with a digital mode and they are running QRP, I am still filled with wonderment at the success of these modes. I did start to experience a problem and thought perhaps it was an imperfection in the software or a failing path. Then I realized the missed print was simply where my computer is just a bit too slow for the software to function.

After ending the otherwise successful QSO, I checked and sure enough, the author's (Nino IZ8BLY) recommendation for success is to use a CPU running at least 166 MHz. My 120 CPU did okay, considering, I guess. Something is happening with a lot of the Visual Basic written programs these days. We will have to all get faster computers or settle for not using certain software and/or modes we cannot enjoy.

However, as Nick and I communicated via E-mail afterward, and I pointed him to URLs where he could download MMSSTV and SSTV-PAL, something else struck me that may interest a lot of you.

Nick was expressing concern that, even though he was receiving great images with the MMSSTV, he was hesitant to expect much out of his little peanut whistle when it came to transmitting in that mode. I recalled a conversation with an ardent SSTVer who claimed excellent results with just a few watts using that mode. Of course the path has to be good, but time will tell. I won't be the least bit surprised to see a surge in QRP SSTV sometime soon, especially as I observe so many hams having success with QRP PSK31 and MFSK16.

Another intriguing program is coming along that will surely be available by the time this issue hits your porch. The new version 2 of MixW is well enough along that I happened onto Jim WA2VOS on MFSK16 one afternoon. Jim, as you may be aware, is deeply smitten with the MixW bug and it would appear to me this will possibly be an answer to some of the ills I am experiencing with some software packages on this slow computer.

Just as an aside, I would like to remind you that I use this computer as a sounding board (wouldn't refer to it as a benchmark) to separate the programs that are too "fat" and won't run correctly on these "resources-challenged machines" from those that are written to work flawlessly under limiting parameters. This is not to condemn the work that has been donated so gratuitously by so many dedicated hams.

It is all good programming that promotes the betterment of digital hamming. However, I find hams complaining that some of this really great software just won't run on their 66 MHz CPU. There are digital programs, of a limited variety, that will perform well on those older machines. So the fun can be experienced by everyone.

MixW (Vers. 1.45) is one of the few programs I have that is written with good tight programming in C++ that seems to perform flawlessly at every turn. And that is highly commendable. Nick UT2UZ, the author, does a remarkable job in the art of programming.

And there are many other contributors to whom we all owe thanks for helping us to enjoy the digital modes. No one has made a "bad" contribution to the effort.

I made an agreement (compromised my principles?) with my wife. The story is that we got her a new computer last Christmas. It was a bargain basement buy. The advantage is the competition is eliminated for this "main" computer There is more to the story. At the time of purchase a commandment came down from on-high that "there are to be no ham radio programs on this computer."

If we look at today's major story, I have broken the rules. But it is all in the interests of promoting the science of ham radio. The masses will benefit from these subversive activities.

Source for:	Web address (URL):
Mix W Soundcard program for PSK31, RTTY, new modes, MTTY, FSK31, more	http://tav.kiev.ua/~nick/my_ham_soft.htm http://users.nais.com/~jaffejim/mixwpage.htm
FREE MMHam site — MMTTY — MMSSTV	www.geocities.com/mmhamsoft/
FREE VK7AAB — SSTV-PAL — PSK-PAL	http://users.origin.net.au/~crac/
Much ham info w/SSTV downloads	www.conknet.com/~kb1hj/index.htm
TrueTTY — Sound card RTTY w/ PSK31	www.dxsoft.com/mitrtty.htm
Pasokon SSTV programs & hardware	www.ultranet.com/~sstv/lite.html
PSK31 — Free — and much PSK info	http://aintel.bi.ehu.es/psk31.html
Interface for digital - rigs to computers	www.westmountainradio.com/RIGblaster.htm
Soundcard interface info — includes Alinco	www.packetradio.com/psk31.htm
Interface info for DIY digital hams	www.qsl.net/wm2u/interface.html
WinWarbler info and free download	www.qsl.net/winwarbler/
MFSK-related tech info — how it works	www.qsl.net/zl1bpu/
Throb — New — lots of info	www.lsear.freeserve.co.uk/ www.btinternet.com/~g3vfp/
Download Logger, also Zakanaka	http://www.qsl.net/ko4elo/
PSKGNR — Front end for PSK31	www.al-williams.com/wd5gnr/pskgnr.htm
Digipan — PSK31 — easy to use	http://members.home.com/hteller/digipan/
TAPR — Lots of info	www.tapr.org
TNC to radio wiring help	http://freeweb.pdq.net/medcalf/ztx/
ChromaPIX and ChromaSound DSP software	www.siliconpixels.com
Creative Services S/W Multimode w/PSK	http://www.cssincorp.com/products.htm
Timewave DSP & AEA (prev.) products	www.timewave.com
Auto tuner and other kits	www.ldgelectronics.com
XPWare — TNC software with sample DL	www.goodnet.com/~gjohnson/
RCKRtty Windows program with free DL	http://www.rckrtty.de/
HF serial modem plans & RTTY & Pactor	http://home.att.net/~k7szl/
SV2AGW free Win95 programs	www.raag.org/index1.htm
Source for BayPac BP-2M & APRS	www.tigertronics.com/
Int'l Visual Communications Assn. — nonprofit org. dedicated to SSTV	www.mindspring.com/~sstv/
Hellschreiber & MT63 & MFSK16 (Stream)	http://iz8bly.sysonline.it
HamScope — multimode w/ MFSK16	http://users.mesatop.com/~ghansen/
YPLog shareware log — rig control — free demo	www.nucleus.com/~field/

Table 1. The Chart.

So this is what happened

I kept looking at this new piece of equipment that was sitting mostly idle on the next desk here in the shack and it finally broke down my resistance. First, it was necessary to extend the cable connections from the rig to the soundcard. That was simple to fix with a trip to Radio Shack. Two audio cable extensions for transmit and receive and the tests could begin.

I loaded in one of the culprit programs and, to my utter dismay, it worked very little better in the new whiz-bang computer than it did in this old one. Something was proven, or maybe disproven, and I am enough out of the loop that it really wasn't making nor breaking my day ... yet.

Fortunately, there are plenty of other programs to be tried. So, I went with one of my favorites that works like a million in this computer and it had severe problems copying in the new computer. It did, however, transmit what appeared to be normally. I was gaining, but still unsure of where this was leading.

Program of the day

The next software package I wanted to try was the Zakanaka. I had managed minimal success with that program in one of its earlier forms in the slow machine. The program is meant to run hand-in-hand with Logger. but if I tried that with the 120 MHz CPU it spelled c-r-a-s-h. I really wanted to see this combo work, especially since the MMTTY engine had been incorporated into the Zakanaka.

I installed the latest version and, Bingo! it copied PSK like a champ. Plus, I might add. RTTY print is as near perfect as can be. I wrote a few macros and settled into the task of making a contact with manual Xmit/Recv toggling by leaping from one desk to the other. It worked well. The reports were good, which meant I had successfully adjusted the audio drive.

Next chore — Two more cables and these had to be extended with plugs and soldering iron mode. It took a while, and there were a few complications due to the layout of the jacks on the fancy new computer, but I came up with the essential PTT. No more leaping up and down. I was thinking ahead to quick RTTY exchanges and I might have tripped and strangled myself on some of the cable during one of those fast toggles.

There is one large detail I was overlooking up to this point. The help file for Zakanaka is exquisite. I don't think I noticed a single spelling or grammar error, and it is written by hams who were interested in making the user a success so it is in do-it-this-way format.

Why is this a large detail? I decided it was simply too bulky to read through on the monitor, so I downloaded it and printed. I want you to know this is quality stuff. I chose the Adobe Acrobat version and it is filled with visual aids and references to cover about every contingency. And it is 240 pages!

That sounds a little intimidating, but it was worth my while. I have not read it word for word, but I believe everything you could want to know about the use of this program, how to hook up to your rig, what buttons to click and the necessary settings to make it work are all in there.

As I was penciling in page numbers, I ran across the items I needed most and went back and finished the setup. When I was through, I had a logging program installed that read the frequency of the radio and a communications program that automatically "knows" the frequency the program is transmitting and receiving on and displays it.

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Summer and Field Day!

It's that time of year again: Each year, the American Radio Relay League (ARRL) sponsors an emergency preparedness exercise called Field Day. The event takes place during a 24-hour period on the fourth weekend of June.

Individual hams and ham clubs compete to make as many contacts as they can from remote locations using emergency power and portable stations. For 2001 the event starts at 1800 UTC on June 23rd and continues till 1800 UTC on the 24th. The Radio Amateur Satellite Corporation (AMSAT) promotes its own version of Field Day for operation via the hamsats, held concurrently with the ARRL event.

AMSAT Field Day 2001

While the ARRL [http://www.arrl.org] rules provide a 100-point bonus for the successful completion of a single amateur-radio satellite contact, the AMSAT rules promote activity on all of the current operational satellites. The AMSAT [http://www.amsat.org] rules worked reasonably well last year, but show some important changes for 2001 regarding the use of the single-channel FM satellites like UoSAT-OSCAR-14 (UO-14) and AMRAD-OSCAR-27 (AO-27).

The congestion on UO-14 and AO-27 was so intense in 2000 that some stations running over 100 watts on the two-meter uplink to high-gain yagi antennas couldn't make a single contact. A few very-well-equipped stations dominated the field and made it virtually impossible for those with small antennas and reasonable power levels to get through. The newly modified AMSAT rules (presented here) now only allow ONE contact per each FM, single-channel satellite. Although it is doubtful that those stations with dual-band HTs using simple whip antennas will get through even with the new rule, it is hoped that more folks will at least get a chance to make a contact. Stations that have completed their single contact via a particular FM satellite, are encouraged not to make any further contacts via that satellite during the Field Day period.

The first-place emergency power/portable station will receive a plaque at the AMSAT General Meeting and Space Symposium in Atlanta, Georgia, October 5–6, 2001. Certificates will be awarded for second and third place portable/emergency operation in addition to a certificate for the first-place home station running on emergency power. Stations submitting high, award-winning scores will be requested to send in dupe sheets for analog contacts and message listings for digital downloads. Check the AMSAT Web page for details and a sample entry form.

There are some good reasons to consider participating in the AMSAT event if you are serious about chasing satellites on Field Day. The AMSAT rules recognize the individual hamsats as separate bands, thus promoting the pursuit of all of the "birds" for the duration of the event. AMSAT also recognizes digital satellite activity. Special Field Day messages are sent to the "digisats" for download points by anyone who can receive them. It's even possible to participate in the AMSAT event and get points without a license. While monitoring the downlink from the digisats, complete short Field Day greetings messages can be received without ever transmitting.

Making choices

It would be nice to try to work every active hamsat in the sky on Field Day, but it's just not possible without a lot of gear and a lot of club members or active participants in the satellite chase. The best thing to do is to pick satellites that have transponders, either analog (voice and CW) or digital (1200 or 9600 baud), for which you have equipment.

If you are considering ONLY the FM voice satellites like UoSat-OSCAR-14 or AMRAD-OSCAR-27, don't, unless you are simply hoping to make one contact for the ARRL rules bonus points. Even with the rule changes for 2001, the FM voice satellites turn into a solid FM-repeater pileup during Field Day. It's fun listening, but that's not what Field Day is all about. Diversify. Gear up for other voice/CW hamsats.

If you have worked the satellites on Field Day in recent years, you may have noticed that a lot of good contacts can be made on some of the less-populated, low-earth-orbit satellites like Fuji-OSCAR-20, Fuji-OSCAR-29 and RS-12/13. During a typical workweek, contacts are few and far between, but during Field Day the transponders come alive like 20 meters on a weekend. The good news is that the transponders on these satellites will support multiple simultaneous contacts. The bad news is that you can't use FM, just low duty-cycle modes like SSB and CW. AMSAT-OSCAR-10 can also be a lot of fun on Field Day if the solar panels are properly illuminated and it is in a good position in the sky for Field Day. Plot some orbits and check it out.

Equipment

The best radios for Field Day are the ones you use at home, unless of course, they are heavy antiques. If you have one of the newer, all-mode HF/VHF/UHF transceivers, take it with you. If you don't have one, find someone who does, and borrow it. Be sure that it can transmit on one satellite uplink band while receiving another. Practice prior to the event. There's nothing worse than trying to figure out a strange radio while you are hunting for a satellite, keeping tabs on uplink and downlink frequencies, and adjusting for Doppler, all at the

same time. If at all possible, have a back-up station. During one Field Day event, our group had to dig out the back-up to the back-up due to power problems.

Be prepared to at least work SSB and CW on Mode J (two meters up and 70 cm down) via the Fujis. It is doubtful that AMSAT-OSCAR-40 will be available for use, but with a nice set of two-meter and 70-cm directional antennas, AO-10 Mode B (70 cm up and two meters down) can be a lot of fun on a good day.

Unless you have experience with low-power satellite work, don't try satellite "QRP" on Field Day. It's really hard even for the best satellite operators, and can be quite difficult and disappointing to demonstrate to potential newcomers. There are too many inexperienced satellite operators on the air during Field Day, and many are trying to deal with noisy generators, bugs, and unfamiliar radios. Listening for weak stations is too much to ask.

Antennas

A simple system for RS-12 or RS-15 Mode A can get by with a dipole in the trees for 10 meter reception and a ground plane in the clear on the two-meter uplink. Most serious satellite operators will have an antenna system that will rival many home stations with large circularly-polarized yagis positioned by azimuth and elevation rotors. Something in between these extremes should suffice.

Predictions

Don't assume that you can take a laptop computer to Field Day and do your predictions after you get there. Plot all of your potential satellite passes in advance for every satellite you intend to pursue. Check the results. Look for timing conflicts. Make sure that the coordinates of the Field Day site and recent satellite element sets have been entered into the software. Don't forget to take along some satellite frequency guides unless you are one of the few who has memorized all the uplink and downlink bands for all of the hamsats in orbit.

Power and interference

There is nothing worse than having all the gear, antennas, predictions, and accessories ready to go, and then discovering that you can't hear anything but noise on the downlink frequencies. It happens a lot. Noisy power sources are the number-one culprit. If you can operate with batteries, do it. Satellite chasing is considered weak-signal work. Most of our hamsats only have a few watts output to simple antennas. They can be hard to hear. A typical consumer-grade gasoline generator can produce a lot of noise in the RF spectrum. Be sure to test your generator prior to Field Day. Check it with your satellite rig for a few passes. If it is noisy, either cure the problem or get another power source.

Don't forget about "the other guy." Most Field Day operations include multiple stations for HF, VHF, and satellite work. The folks in the tent next door on 10 meters can ruin your best attempts to make Mode-A contacts. Coordinate with them so that they can go to another band or take a break during those short intervals when the RS hamsats come by.

If your group operation has any terrestrial VHF stations or two-meter packet systems, they can destroy any chances you might have had hearing AO-10 on Mode B with its two meters downlink. As with the HF folks, make your intentions known and arrange for an operating schedule, in advance. Even with all these precautions, it is always a good idea to isolate the satellite station from the others. A high-power 20-meter SSB rig will almost always mess with a 10-meter receiver just a few feet away.

Have fun!

You may have multiple rig difficulties, antenna failures, computer glitches, generator disasters, tropical storms, and even satellite problems, but the goal is to test your ability to operate in an emergency situation. Try different gear. Demonstrate satellite operations to hams that don't even know that the hamsats exist. Test your equipment. And finally, have fun doing it!

The ARRL Field Day hamsat rules

The following item is from the American Radio Relay League Field Day rules at the ARRL Web site.

7.3.7. Satellite QSO: 100 bonus points for successfully completing at least one QSO via an amateur radio satellite during the Field Day period. Under the "General Rules for All ARRL Contests" (rule 3.7.2.), the no-repeater QSO stipulation is waived for satellite QSOs. Groups are allowed one dedicated satellite transmitter station without increasing their entry category. Satellite QSOs also count for regular QSO credit. Show them listed separately on the summary sheet as a separate "band."

The AMSAT Field Day rules

The AMSAT Field Day 2001 event is open to all amateur radio operators. U.S. and Canadian amateurs are to exchange ARRL section and Field Day transmitter class. Foreign amateurs should exchange country name and signal reports. The AMSAT competition is to encourage the use of all amateur satellites, both analog and digital. Note that no points will be credited for any contacts beyond the one allowed via each single-channel FM satellite. Operators are encouraged not to make any extra contacts via these satellites (ex.: UO-14 & AO-27). CW contacts and digital contacts are worth three points as outlined below.

1. Analog Transponders

• Each satellite transponder is considered a separate band.

• All phone QSOs and all CW QSOs on a given satellite transponder are considered separate bands.

• All packet/RTTY/ASCII/AMTOR QSOs through analog transponders are counted as CW QSOs.

• Phone QSOs count for one point and CW QSOs count for three points.

• Cross-mode (CW/phone) contacts are not allowed.

• Only one contact is allowed via each single-channel FM satellite.

• The use of more than one transmitter at the same time on a single satellite transponder is prohibited.

2. Digital Transponders

For the Pacsats (LO-19, KO-25, etc.), each satellite is considered a separate band. Do not post "CQ" messages. Simply upload ONE greeting message to each satellite and download as many greeting messages as possible from each satellite. The subject of the uploaded file should be posted as Field Day greetings, addressed to ALL. The purpose of this portion of the competition is to demonstrate digital satellite communications to other Field Day participants and observers.

The following uploads and downloads count as three-point digital contacts.

(a) Upload of a satellite Field Day greetings file (one per satellite).

(b) Download of satellite Field Day greetings files posted by other stations. Downloads of non–Field Day files or messages not addressed to ALL are not to be counted for the event. Save DIR listings and message files for later "proof of contact."

Sample satellite Field Day greetings file

"Greetings from N5EM Field Day Satellite station near Katy, Texas, with 20 participants, operating class 2A, in the

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Mobile, Portable and Emergency Operation

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Attention, Newcomers!

I've noticed lots of new hams on the air lately, and I'd like to extend a huge welcome to each and every one of you. Not only is it great to be able to chat with you on the local repeater or the low bands, but I'm looking forward to your help during the next emergency. If you're new to the hobby, there are a few suggestions I have that might prove useful. Maybe you already know about these tips, but I figured I'd bring them up just in case. Besides, it's kind of hard to remember everything when a disaster hits and you're headed out the door to help out.

The most convenient and popular type of radio is the handie-talkie or HT. It is also the least effective in many ways. A handie-talkie is convenient because it has a self-contained power supply, but that also means that it has a limited power supply. It has a convenient belt clip and a flexible "rubber ducky" antenna. It seems to be the ideal tool for responding to a disaster or emergency, and is helpful if you know some of the tips to making it work.

First, let's talk about the power supply. Most HTs come supplied with a single battery pack. Often the battery that is included is modest both in terms of transmitter output and duration of operation. Most manufacturers, as well as independent battery companies, offer battery packs that offer an extended life as well as packs that provide the maximum output. It's usually a trade-off so that you can have one feature or the other. If I have to choose, I usually prefer to get the battery that provides the high output and purchase a second battery pack. Although it's a little more expensive, I then purchase two battery packs to provide the endurance. What's the difference between the two? The battery that provides higher output normally operates at a higher voltage. The longer-lasting battery has a comparable number of cells, but wired in parallel so you have a lower voltage with a larger current capacity.

In many cases, there are alternatives to the standard battery pack, and for extended operations you may elect to use a different power supply. An HT can be operated from an automobile battery using the cigarette lighter adapter. Of course, the benefit of an HT is that you can carry it to a location where your car cannot go. For these situations, there are commercial power systems available that include a gel cell, charger, and connectors in a single package. Many utilize a cigar lighter type of outlet, so the same adapter used to power a radio in a car can be used with this type of power supply. Of course, it is possible to build a power supply that accomplishes the same thing using either a gel cell or dry cells. A plastic box such as the type used for saving leftover food can be fitted with battery holders for C or D cells and a connector, for only a very small investment. This type of home-brew power source is ideal for operating from a fixed site, such as a disaster services shelter. You can use it while portable by using a backpack or a small bag with a shoulder strap.

The handie-talkie's convenient rubber ducky is fine for operating in an area that has great repeater coverage. During a disaster or emergency you will probably have to operate simplex or at the fringes of a repeater, and may find its performance just shy of disappointing. The rubber ducky is physically shortened to be more convenient for day-to-day use. Like any antenna system it needs to work against a counterpoise — in a dipole antenna one leg of the antenna operates against the other, while a vertical operates in conjunction with its radials. The rubber ducky is a vertical antenna, and marginally operates with the radio case as the counterpoise. When you're holding the radio you are sort of kind of loosely capacitively coupled to it, so you act as a very inefficient counterpoise.

There are a couple of things you can do to improve the operation of your HT. First, when operating, take the HT off your belt. If your body can couple to the body of the radio when holding it in your hand, it can act similarly when the antenna is parallel to your torso with the radio clipped to your belt. Second, if possible, use a better antenna when operating in a remote area or on simplex. A 1/4-wave antenna will provide some improvement, and you can choose between either a flexible or a telescoping version. I prefer a 5/8-wave telescoping antenna even though it is a bit longer. In either case, a "real" antenna will operate much better than the rubber duck. If you operate from a fixed location, a J-pole antenna made from 300-ohm television twinlead is a big help, or you can use a magnetic mount mobile antenna on top of a filing cabinet or other metal surface. Incidentally, in most cases your 2-meter antenna will resonate adequately if you operate 440 MHz on a dual-band rig.

One other trick you can use to improve your transmission is to add a more effective counterpoise to your antenna. Units available commercially include the popular "Tiger Tail." Again, you can build something similar yourself by attaching a piece of wire to the outer portion of your HT's antenna connection. The wire should be somewhere about 19-1/4" long and can be attached by using a large solderless lug. If your antenna has a BNC connector, choose a lug size that can fit over the BNC barrel. You may have to file notches in the lug to permit it to pass over the two "ears" on the connector. Reinstall the antenna over the lug, let the wire tail drop naturally, and you should notice a difference.

In a disaster we need all the help we can get, and those of you new to the hobby are

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Radio Direction Finding

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RDF Secret Weapon Revealed

One of the most appealing aspects of ham radio is that it's a worldwide hobby. I have been fortunate to visit many countries and have met friendly hams every time. Many of them are fans of radio direction finding (RDF), either mobile (T-hunting) or on foot (foxtailing, radio-orienteering, and ARDF).

In most countries, geography and the high cost of fuel make foxhunting on foot more popular. Such hunts are also perfect for introducing young people to our hobby. About 30 countries are active enough to be represented on ARDF Working Groups of the International Amateur Radio Union (IARU). Others are just discovering the fun. For instance, in recent weeks I have received inquiries about starting ARDF activities from hams in Spain, El Salvador, and Singapore.

As ARDF Coordinator for IARU Region 2 (North and South America), I am particularly eager to make new contacts in Central and South America. USA and Canada have growing ARDF programs, and it's time for the activity to spread southward. When you're on the DX bands, talk about your ARDF activities and encourage those whom you QSO to give it a try. Refer them to the "Homing In" Web site for more information.

If your summer travels this year will take you to Europe or Asia, check out the radio-orienteering action while you're there. Several countries, such as Belgium and Germany, have regular ARDF events where visitors are welcome. Championship opportunities overseas this year include the 13th IARU Region 1 ARDF Championships (September 12–16) in France, the 3rd IARU Region 3 ARDF Championships (August 23–28) in Mongolia, and the "5 Days ARDF 2001" event (July 3–8) in the Czech Republic. The "Homing In" Web site has links and contacts.

To get to the best foxtailing challenge of summer 2001 for American hams, you won't have to travel nearly as far. The First USA ARDF Championships get under way July 31st in Albuquerque, New Mexico, with hams from all over the USA and the world expected to vie for the medals. The two-meter hunt will be on August 2nd and the 80-meter event on August 3rd. Both will be in beautiful forested country near this intriguing desert city.

Based on my recent meeting with leaders of the Albuquerque Amateur Radio Club, I know that they will be putting on a first-class event. If you haven't already registered, go to my Web site and link to the USA Championships site for all the details and a registration form, or send postal mail to me. Remember that the event is for beginners and experts alike. Training sessions take place on the first day, taught by the most experienced hunters available. You'll also have opportunities to learn about many types of RDF gear for the 2-meter and 80-meter bands (**Photo A**). See you there!

Hunt your way to the pub

If your foreign travels take you to Canada, Australia, Japan, or Italy, check out the mobile T-hunting action there. Most T-hunters in these lands build all of their RDF gear, much of which is quite sophisticated.

"Homing In" for April 2001 introduced Dave Bullock G6UWO. He told about the challenging series of hunts put on every summer by the Amateur Radio Club of Nottingham (ARCON), about 100 miles north of London. Dave and his foxhunting

Photo A. Besides challenging competition, international ARDF events are a great place to learn how to improve your RDF equipment. Rik Strobbe ON7YD (left) is discussing two-meter fox transmitter and turnstile antennas with attendees at the 1999 IARU Region 2 Championships in Portland, Oregon.

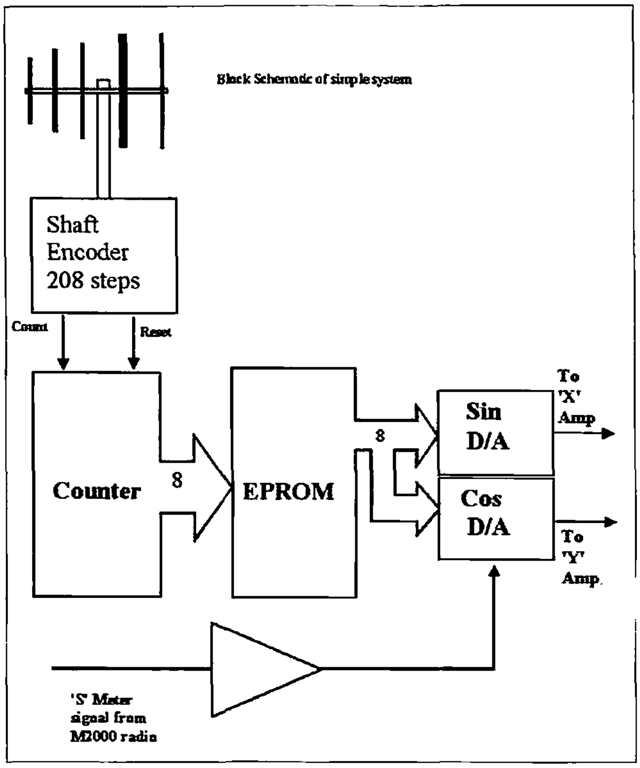

Fig. 1. Block diagram G6UWO's first Whirligig system.

partner John Wood GØPSI have another concern right now — the recent outbreak of foot-and-mouth disease that has made many rural areas off-limits to prevent the spread of this virus. "I sense that there is a bit of panic beginning to set in amongst the farming community," he wrote. "People living outside the affected areas are endorsing the latest government idea to kill all stock within a two mile radius of every outbreak. Of course, those in the proposed zones with prize herds are not convinced!

"It could be that we will be restricted to transmitter hunting in built-up areas only," Dave continued. "Yuck, I hate hunting in town! It is so dangerous with all the traffic jams and hunters racing to get there first. Personally, we enjoy the drive in the countryside as much as the competition — especially the post-hunt gathering at a quiet village pub."

Hams in Nottingham take their monthly two-meter mobile T-hunts very seriously, keeping careful track of the results of each hunt and awarding a trophy each year to the most successful team. Dave and John won it again in 2000 (that was their fifth consecutive year) and credited their RDF "secret weapon."

I decided to find out how secret it is. Dave is justifiably proud and was eager to tell how it came about and how it works. Maybe that's because he's 5,300 miles away, so I'm not likely to use the information to compete against him!

Dave told me that ARCON members use a wide variety of equipment, from doppler sets to the simple HB9CV phased beam and a handie-talkie. "We had already been instrumental in introducing the first doppler system into the club's hunts, based on the 1981 design in *73 Magazine* by Dave Cunningham W7BEP," he wrote. "Whilst it worked well sometimes, we conducted tests and found that the multipath environment was the ideal place to hide to confuse a doppler system. It would just lock on to the strongest signal, whether direct or reflected! This was hopeless, as at that time industrial estates and heavily built-up areas were favored by the fox.

"What we needed was a system that would be able to differentiate between all these direct and reflected signals," he continued. "John had been reading about wartime submarine hunters and was impressed by their simple rotating loop and cathode-ray tube (CRT) display systems. These quickly locked onto the submarine as it popped up to make its clandestine transmission. The direction and signal strength were displayed as a vector display on the CRT. This seemed like a good idea as, unlike the doppler, the display would show all of the signals arriving at the vehicle, which is exactly what we wanted!

"From our experiences with the doppler, we knew that 1/4-wavelength whips were not sensitive enough for this application. There were a few times when we couldn't hear the fox from the start. It's very frustrating having to drive from high spot to high spot, hoping for a signal! By the same reckoning, loops were out, too. What we needed was lots of gain and directivity — a beam!

"The system should rotate the beam antenna on the top of the car, connected to the two-meter RDF radio. The output of the S-meter circuit from that radio should be displayed on a readout device. A circular timebase should be synchronized to the rotation of the antenna such that the signal strength information is swept around the screen. A compass ring around the diameter of the CRT should show the bearing in degrees. Finally, there should be a foolproof way of transferring that bearing to the map."

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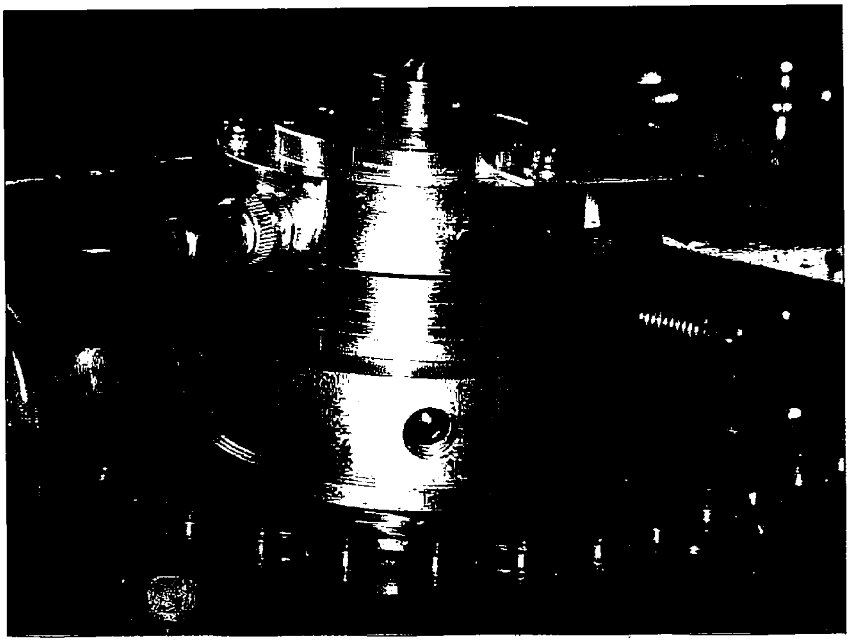

Photo B. A chain drive turns the antenna and an old VCR headwheel couples the RF signal.

Electronic trigonometry

At this point, long-time "Homing In" readers should have a strong feeling of déjà vu. In places such as southern California, the buildings and mountains reflect VHF/UHF signals and hidden transmitters are frequently shielded by terrain. The signal at the start point is often weak, indirect, and horizontally polarized. That means that dopplers are unsuitable much of the time. Many T-hunters have recognized the advantages of coupling the output of a rotating high-gain antenna to a circular-trace (polar) readout.

About forty years ago, the late Jim Davis W6DTR made a polar RDF display, driven by a hand-turned two-element phased array for two meters or a loop for 75 meters. Jim became unbeatable because his equipment was far more advanced than any of the other T-hunters had. I described his display, which used a surplus CRT with long persistence (P7) phosphor, in my book.[1]

You may remember from a math class that polar coordinates are represented by an angle (signified by the Greek letter theta) and the radius (r). In a polar display, magnitude of r is proportional to signal strength. An ordinary oscilloscope has x (horizontal) and y (vertical) deflection plates or coils. To display polar magnitudes, they must be converted to x and y axis voltages. The value of x equals r times the cosine of theta. The value of y equals r times the sine of theta.

We need a device that outputs voltages proportional to the sine and cosine of the beam's pointing angle. W6DTR used a sine-cosine potentiometer. It has special windings that generate voltages proportional to the sine and cosine of the shaft angle when driven by a reference voltage. My book also outlined how the sine and cosine signals can be generated electronically by storing the x and y voltage values for each theta in a lookup table in a programmable read-only memory IC (PROM). Digital-to-analog (D/A) converters turn these PROM-stored values to sinusoidal analog voltages used to drive the CRT. Receiver S-meter voltage (r) is applied to the reference voltage input of the D/A converter.

Since then, creative stateside hams have built polar readouts optimized for their own hunting circumstances. "Homing In" has featured five of them. The first was JaMi Smith KK6CU of Pasadena, California, who rotated a 3-band 6-element cubical quad at 40 RPM with a motor and displayed the signal traces on a Tektronix medical storage oscilloscope monitor. Motor and monitor were powered by a 400-watt squarewave DC-to-AC inverter. He made an in-line rotary coupler (slip rings) out of a two-element continuous-turning potentiometer to pass RF from the spinning quad to his receiver.[2, 3]

Next came Jerry Boyd WB8WFK, who mounted a continuous-turning linear taper potentiometer to his antenna mast.[4, 5] The azimuth reading and S-meter voltage went to an interface box for digitizing. A laptop computer crunched the data and displayed a plot of amplitude versus direction on the computer screen.

Two Santa Barbara–area hams, Kerry Provancha KK6OS and Tom King KA6SOX, made a long-persistence polar display out of an old marine radar set and named it RADAD.[6] Their unique yagi had a fixed half-wavelength vertical driven element with parasitic elements rotating around it, eliminating the need for slip rings. Bill Rupp NØMKJ of Milwaukee is proud of his motorized quad system, which he calls the Foxcopter.[7] It uses a mercury-filled rotating electrical coupler from McMaster-Carr[8] to provide slip rings for the RF signal.

My own system, the NorthScope[9, 10], substitutes the sine and cosine outputs of a mast-mounted fluxgate compass in place of the sin-cos pot. The resulting polar display is always relative to true north, which aids navigation on winding hilly roads. The high-persistence CRT readout, made from a vintage Heath SB-620 Scanalyzer, draws less than one ampere from the car battery.[11]

Like W6DTR and WB8WFK, I prefer a manually-turned antenna instead of motorized, because I like to swing the quad back and forth by hand to find the precise direction of the strongest peak of a fluttering signal on

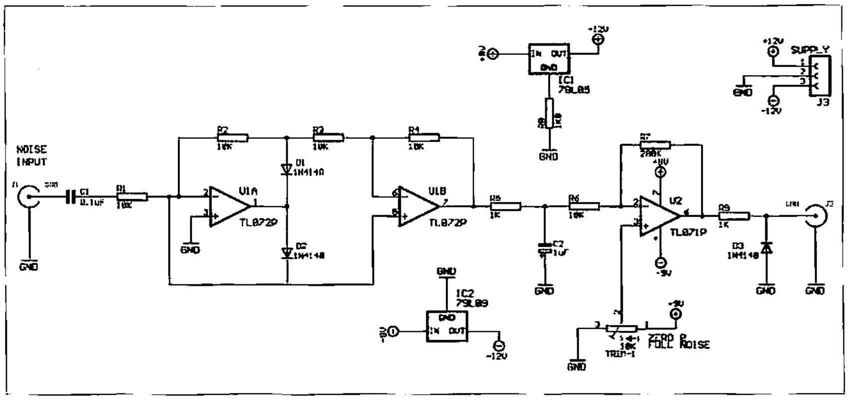

Fig. 2. Schematic of the noise detector. It is drawn in the European convention, which uses rectangular boxes for resistors.

the display. Slip rings are not needed in a hand-turned system.

First whirligig in Nottingham

G6UWO and GØPSI read about W6DTR's system and electronic generation of sine-cosine signals in my book, but they didn't see any of the "Homing In" articles. The system that they developed independently has similarities to them all, but it also has some clever enhancements, as you will see. **Fig. 1** is the block diagram of their "Mark I" version. The optical encoder from an old hard disk drive provides mast pointing signals to clock an 8-bit converter that counts up through the memory locations of the PROM. Digital sine and cosine values from the PROM go to D/A converters, driving the x and y coils of a medium-persistence CRT display.

Dave and John's rotating antenna, pictured in "Homing In" two months ago, is a five-element "J-beam" mounted for vertical polarization. They are still improving that part of the system. Dave's latest E-mail states, "Preliminary tests with trigonal reflectors last year showed better front-to-back ratio and reductions in the interfering signals off the side of the antenna when moving. We tested all sorts of reflector arrangements, altering the number of elements, the spacing, and the angle of the reflector mini-booms to the main antenna. Our polar display lends itself beautifully to plotting the antenna patterns. We are commencing pre-season testing, hoping to solve the problem of the slight loss in forward gain caused by extra elements."

John's assignment was to design the rotating mechanism. "We wanted a very sturdy system that could rotate the beam whilst driving at up to 70 miles per hour," Dave declared. "Out of John's bottomless junk box came an automobile windscreen wiper motor, a couple of bicycle chain wheels and a length of chain. He made the main antenna bearing from an Austin Mini front wheel hub and bolted the whole assembly to a couple of surplus ladder racks. The 12-volt motor and chain wheels provide a 1:1 drive and spin the antenna at 60 RPM. The stub mast is hollow, allowing the antenna coax to pass down its center to our rotating joint.

"Having scoured the Internet for "noise free" rotating coaxial joints and only finding some that were very expensive, we decided to develop our own," Dave went on. "We found that the head assembly from a VHS video recorder contains a rotating RF transformer to transfer signals from the "flying" heads to the chassis. We replaced the coils in a VCR transformer with single turn loops and, with a bit of care, produced a rotating joint with just 3 dB insertion loss and less than 0.5 dB eccentricity." (See **Photo B.**)

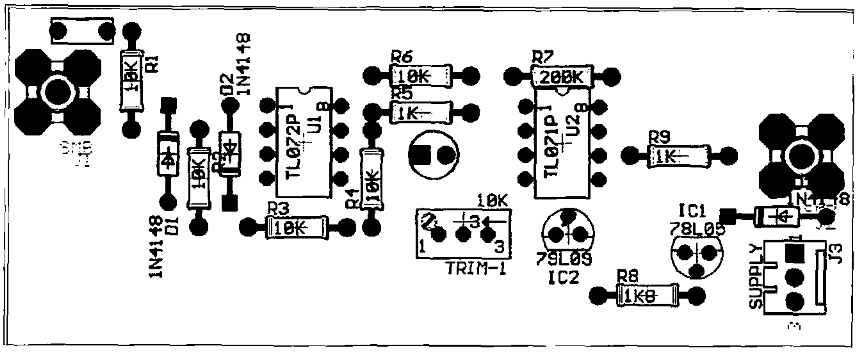

Fig. 3. Noise detector component layout.

"We carried out tests on our two-meter radios and found that they were very lacking in the S-meter department. My Yaesu FT-290 had less than 9 dB RF input range from zero to full-scale. Visiting radio rallies and talking with local hams, we discovered an ideal radio, the Pye M2000 Private Mobile Radio (PMR) set. It produces a linear output voltage swing of zero to 3.75 volts over a 70 dB RF signal strength variation. In our system, this proportional DC voltage is fed, suitably scaled, into a buffer amplifier and then into the input of the A/D converter. As there are no RF gain controls on the M2000, there is always the same relationship between signal strength and this buffered output, ideal for estimating distance to the fox."

The display helped Dave and John win another annual trophy, but they wanted something even better. Next year they were back with the "Mark II" version. One feature was a noise plotting function. **Figs. 2** and **3** are the schematic and parts layout. "Used on weak signals, it rectifies the audio from the radio to produce a DC voltage that varies inversely with the amount of quieting in the receiver," Dave explained. "This voltage is fed to the display in the same way as in signal mode. Using this mode, the sensitivity of the system is extended by 20 dB."

Next time, I'll cover more of the improved version, which has "electronic persistence" and a unique way of accurately transferring bearings from the CRT screen to paper maps. Meanwhile, keep those letters, photos, and E-mails coming to the addresses at the beginning of this article.

Notes

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[10] "Homing In: Build the NorthScope," *73 Magazine*, August 1997.

[11] "Homing In: Low-Cost Monitor for the NorthScope," *73 Magazine*, September 1997.

Dan Metzger K8JWR
6960 Streamview Dr.
Lambertville MI 48144

Hamfest Loser

When you put your money in your shoe, anything can start to happen.

> *"We'd better say 73, Johnny. We're nearly to Bowling Green, and we're starting to lose you. This is K8JWR, mobile on 160."*

It was September of 1962. Dave and I were both 18, and on our way to the big Findlay Hamfest to make a killing. I had a 160-meter AM mobile in my '52 Chevy, Old Smoky, and we were saying so long to our friends in Toledo. Mobile on 160 was a snap: Open up the tuning slugs in the car's AM radio to raise the top end from 1605 to 1825 kc, steal 200 VDC from the radio's vibrator power supply, whip up a crystal oscillator driving a 6AQ5 to five watts, modulate with a carbon mic driving another 6AQ5, wind a 100-turn loading coil, and you're on!

The big trouble was that the rear suspension of the car kept bottoming out every time we hit a bump. You see, we had about 400 pounds of RG-59U coax in the trunk, and we were fixing to sell it at a penny a foot.

Dave and I had been working for a company that provided cable TV for several apartment complexes in Toledo. (This was before citywide cable came in.) That summer, we had replaced nearly two miles of cable that had losses of up to 6 dB per 100 feet at 200 Mc. It was no good for TV or VHF ham work, but the losses at 28 Mc and below were negligible.

We set up on a picnic table in the park and took turns reeling out the cable. It sold like beer at a ball game on a hot day. When Dave's turn came to man the table, I strolled the grounds to see what the hamfest had to offer. The first thing I saw was a guy with a bushel of big bright red apples — ten cents each. (Remember, this was 1962 — inflation has been about a factor of six since then.) I bought one, and munched contentedly as I continued my stroll.

The second thing I noticed was a military surplus communications receiver — BC-348 or some such number. The reason this caught my attention was that I had been itching to work some 20-meter DX, but my home receiver was an S-85. It had tin foil for a chassis and rubber bands for dial cords. When somebody slammed a door downstairs, the received frequency in the shack upstairs jumped 500 cycles. Military receivers, I knew, were built like the proverbial tank.

The guy was asking 25 bucks for it, and was probably hoping to get $22. I crept behind a tree, checked my wallet, and put all but seventeen dollars and forty-two cents in my shoe. Returning, I put on my best "poor orphan child" act and turned my pockets inside-out for the guy. It melted his heart to see that I was willing to give my last penny for that receiver, and he let me have it.

I really did give almost my last dollar for a 20-meter vertical antenna at the other end of the field. Somebody had told me that you needed a low angle of radiation to work DX on 20, and that a vertical would do it.

When I got back to our table, Dave had just sold the last of the coax, and we split the proceeds — $39.60 each. Triumphantly, we loaded the receiver and antenna into Old Smoky and headed for home. About halfway there, we noticed rain on the windshield — but there wasn't a cloud in the sky. Then we started hearing ominous clunking noises, and the temperature gauge started moving up toward the peg. Water pump failure!

We pulled into a gas station; gas stations didn't sell lottery tickets in those days, they fixed cars. We spent two

This story originally appeared in *The Hertzian Herald*, newsletter of the Monroe County (MI) Radio Communications Association (MCRCA). It reportedly is fiction.

Photo A. Here's the author today, with the Hallicrafters S-85 and Heath DX-35 that survived his 1962 hamfest adventure. The defunct BC-348 and the vertical are long gone.

hours shooting the breeze while an old guy in bib overalls fixed the car. When I looked at the bill, it was $39.50. My hamfest profits were wiped out! But I still looked forward to setting up my 20-meter DX station.

When we got home I put the S-85 face-to-the-wall in a corner and proudly hefted the old military receiver onto the bench. It was sensitive and rock solid on 20 meters. I banged on the top to show Dave that the frequency didn't budge, even under severe shock. The second time I banged it, the receiver went dead.

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Stanley C. Byers
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Glenview IL 60025

Morse Code Decoder Chart

NOT for taking the test.

> *Anyone can learn 5 wpm International Morse Code after a few hours practice with this chart. Then, after learning some electronics theory and radio rules, you can pass the exam under the new 5 wpm rules (without using the chart).*

To use the chart, look at the middle of the left side of it, at the left side of the junction of the "E" and the "T" rectangles. Then if you hear a "dit" or a short sound, move your eye up and slightly to the right to letter "E". If, on the other hand, the first sound is a "dah" or long sound, go slightly right and down to letter "T". If that is the end of the letter sent, you have properly identified it as an "E" or a "T". If the letter continues, simply move your eye slightly right and up for dit or down for dah.

For example, if ". ." is sent, move your eye up and then up again as it goes to the right and stop on "I". If ". -" is sent, go up and then down to "A". If "- ." is sent, go down and up to "N". If "- -" is sent go down and down to "M".

One desirable feature is that the chart encourages the user to concentrate on the letter being transmitted, and not on writing it. Copying a few letters or a few words behind the transmission is characteristic of high speed CW operators. If you start doing what they do, high speed will come quicker and easier.

When I was teaching marine electronics to members of the United States Power Squadron Boating Club, I drew the chart as a supplementary training aid to the text. The students were not required to learn the code, but with the chart they could understand it. For example, they could recognize the one or more Morse letters transmitted by shore-based or floating navigational aids, like flashing lights or radio beacons. When a boater knows the identity of the navigation aid, he can get a fix on his location. That information could be vital in the case of a storm or fog, or the need for urgent help.

The Morse decode flow chart was not original for me. Like everyone else, I stood on the shoulders of others. I saw the chart in a magazine, perhaps 30 or 40 years ago — long before the computer flow chart craze. The chart had enormous impact on my God-given bionic memory. I remembered the chart, but unfortunately forgot the originator and his publisher. My thanks (and apologies) to whoever that might be.

As you can see, a second benefit of the chart is enabling a person to receive an emergency message even though he does not know the code.

A third feature is that the chart is smaller, lighter, and cheaper than electronic Morse code decoders. In addition, it has nonvolatile memory — if you don't spill the coffee on it or store it in the sunlight for too many months. Then, also, you will save money because no batteries are required. You can use your savings to buy more magazines like this one, which helps support unemployed radio/electronic wizards, like me, as free-lance writers.

It is necessary to use a bit of caution while using the chart, because it can become a time gobbler, just like a computer. One Scoutmaster in the US Power Squadron Boating Club heard me explain the chart. But when he demonstrated it to his Scouts, he had a BIG problem. His Scouts went bananas — absolutely bananas — and wanted to keep practicing all night with it. 73

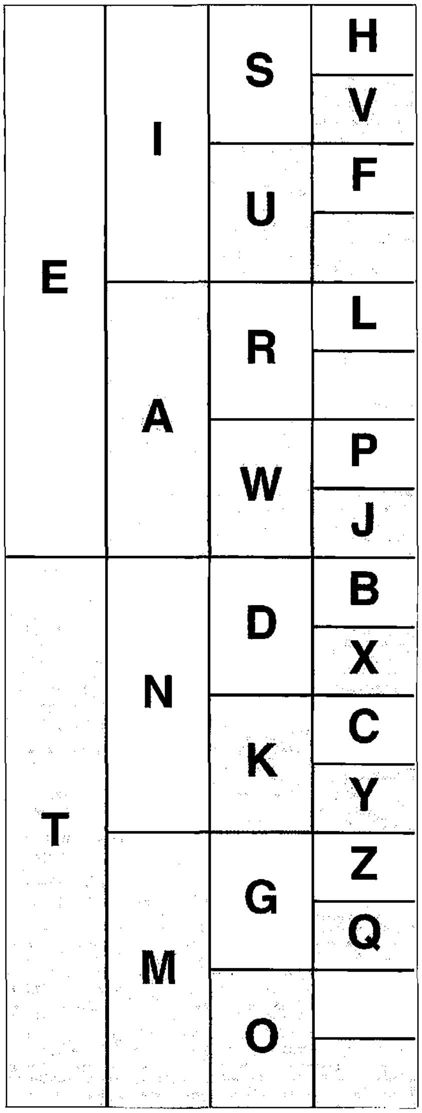

Table 1. *The dummy's dynamite, cyclonite, Morse code decoder flow chart, with non-volatile memory. Read left to right and go up for dits and down for dahs.*

THE DIGITAL PORT

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Also, I found how to get the two auxiliary windows down with their tuning indicators so I could monitor three PSK31 frequencies at once. This required at least a small explanation so I could see what the author had done. Back to the Help file. Very nice indeed.

Something hit me when I was getting the three panes to work and display different messages from different signals. There are other programs that copy multiple signals, but the most of the time we would be contented to have one large screen. I should say we usually desire one large receive pane. With this software you do not have to have the auxiliary panes in place except when you wish to track more than one QSO.

That made a lot of sense to me. Most other multipane software allows you to adjust the size of the individual panes, but here you simply eliminate that which is not needed. No clicking and dragging to distort the default sizes.

Speaking of sizes, I found a solution for us teensy monitor users who wish to have two panels displayed simultaneously while using this software package. To explain why, you will find if you are using Zakanaka interfaced with Logger, you will be frequently clicking the task bar to see what is contained in the Entry box in Logger, then going back to the Zakanaka panel for communication.

If you minimize Zakanaka and expose Logger in the background you can simply move the Entry box for Logger alongside the minimized Zakanaka display. You can see everything that is necessary when you need to see both displays. Then when you are satisfied all is in working order, you can maximize the Zakanaka if you feel the need to access certain controls. Works great until a larger monitor falls down the chimney some future Christmas.

The bells and whistles built into these programs are little short of fantastic. I haven't used the combination long enough at this writing to do them justice, but if I did, I fear the writing would become book length. That is why the Help file is so lengthy. They couldn't describe all the features and tell how to get them working properly and condense it much more.

I am having so much fun with this software after only reading ten pages, I wonder if reading the other 230 will increase the sensation proportionately. I like to read. Maybe it will pay off. The only problem is it isn't the kind of suspenseful plot that you take to bed with you and it keeps you from putting it down. You never know until you tries.

Other happenings

There is a new version of HamScope out, Version 1.3 at this writing. A lot of effort has been put into the upgrade. When I first tested the software, one of the dominant complaints concerned the RTTY module. That problem has been thoroughly overcome by a very sure maneuver. The program works with the MMTTY engine now. Can't get much better than that.

There is now rig control for the popular rigs, and it works. Plus the log function will now start and export directly to Logger as well as the YPLog software. It has become a very complete digital communication package. Well worth a look. You will definitely need a fairly fast processor. All this enhancement eats up the memory.

I will try HamScope in the faster computer now that it interfaces with the rig. In the case of the HamScope, you must install the MMTTY engine in the HamScope file

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The Digital Port

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folder whereas with the Zakanaka, it comes in the package.

I find I have been remiss in keeping up with other developments in this digital world. It seems I have left the Creative Software folk out of my regular visits through digital territory. I see they have now incorporated PSK31 modules in their software for the popular multimode TNCs.

The only one I recall quickly that originally came out of the box ready for PSK31 is the SCS unit and the few of those I have worked were in the hands of very satisfied hams. The sigs were clean and the operators felt they were easy to set up and use. So you know what that means: I will have to dust off the PK-232MBX and give some of these packages a spin.

There are several pieces of software out which achieve similar results. The one that comes to mind as I sit here is the new Version 2 of MixW. The beta testers are saying the program does an excellent job driving the various controllers.

Another program I haven't kept up on is the RCKRtty, which I know works well with the PK-232 and now does PSK31 via the soundcard. There are a lot of options to check out with all the imaginative software developers on the loose out there. There is something to suit every situation.

If you have questions or comments about this column, E-mail me [jheller@sierra.net]. I will gladly share what I know or find a resource for you. For now, 73, Jack KB7NO.

Kenwood's Hot New TS-2000

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menus, it is a breeze to operate. The various menus may be selected by pressing the lower left-hand button for more than two seconds. Repetition of that procedure toggles through the three main menus. A quick touch toggles through each of the four submenus. PTT is toggled by pressing down on the two volume controls on the right, and tuning control is switched from coarse to fine by pressing in on the tuning knob. This is quite an impressive ergonomic design.

Imagine the possibilities. You could have the TS-2000 sitting farther back in the motor home at a favorite operating position, and the head up front by the captain's chair for those rare times that you are actually driving down the road. Included with the RC-2000 are extension cables for the microphone, control head, and for the great sounding speaker that is included. What will they think of next, field programmability of the radio and the head? Stand by!

Wrap-up

We at *73* have devoted two articles to the review of this radio, and we did not cover it all. There is more yet to be said, but that would take away from your own joy of discovery. As I said before, the TS-2000 and its assorted options are formidable examples of what can be brought forth to the market when creativity is allowed to flourish. Kenwood has done a great job on this radio.

I warn you, however: This radio does so much that your own imagination will kick into high gear, and you'll be wishing it did even more!

Bring Back the Magic!

continued from page 23

reasonably technically competent, and, say what you will, this hobby IS a technical one, and long may it remain so. If the license were easily obtained, it will be likewise easily discarded.

I can already hear you asking yourself: "So, what can I do about it?" Well, you can do a lot. Consider becoming an Elmer yourself. Remember the help that you had when you were trying for your license. You can spread the word of amateur radio into schools, colleges, and youth clubs. Put on a few demonstration stations at special events. I realize that there are quite a lot of you doing this now, but we obviously need more. Modern technology is mandatory in amateur radio these days; the PC, for example, is an essential part of a well-equipped modern shack. However, the younger generation can feel some of the magic that we had by constructing something simpler to start with. There are plenty of QRP circuits around that are easy to build and can give a huge amount of satisfaction to the new amateur. To think that a circuit board of approximately two inches square can transmit a signal across that vast Atlantic Ocean — surely, this MUST bring some of that magic back again!?

I wonder what YOU think?

So do we. Is amateur radio a lost cause? Is it possible to bring back the magic? Is the magic even gone to begin with? We invite you to share your thoughts on this by writing to MAGIC, 73 Magazine, *70 Hancock Rd., Peterborough NH 03458, or by E-mailing us, with MAGIC as the subject, at [design73@aol.com]. — ed.*

Hamsats

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AMSAT-Houston group, with the Houston Amateur Television Society and the Houston QRP group. All the best and 73!"

Note that the message stated the call, name of the group, operating class, where they were located (the grid square would be helpful), and how many operators were in attendance.

Satellite digipeat QSOs and APRS short-message contacts are worth three points each, but must be complete two-way exchanges.

The use of terrestrial gateway stations to uplink/downlink is not allowed.

Contacts with the International Space Station (any mode) are not counted for AMSAT Field Day operations, even if available.

If FO-29 is active, the JA transponder can be used for analog CW and phone activities under the analog transponder rules, and the JD system can be used as a separate transponder under the digital rules.

3. Operating Class

Stations operating portable and using emergency power (as per ARRL Field Day rules) are in a separate operating class from those at home connected to commercial power. On the report form simply check off Emergency or Commercial for the Power Source and be sure to specify your ARRL operating class (2A, 1C, etc.).

The Satellite Summary Sheet (AMSAT Web site) should be used for submittal of the AMSAT Field Day competition results to Andy MacAllister W5ACM, Vice President User Services, 14714 Knights Way Drive, Houston TX 77083-5640. Make sure to also send your Field Day photographs with your submission! The deadline for submissions is August 1, 2001. You can also

send your entry sheet electronically to [andrew.macallister@daniel.com].

If your score is in the top five, you will be requested to submit dupe sheets for the analog contacts and DIR listings and downlinked files for the digital contacts. 73

LETTERS

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They are in for a very rude awakening in the Ice Age underway, whether one calls it the Next Little Ice Age, or the Next Major Glaciation, since we likely have already terminated the Holocene Interglacial. They do a great disservice to humanity, since they assume they will have a greater control of their lives, as the number of volcanic eruptions, quakes of 6M and greater, tornadoes, and severe storms is in a rising trend, with high latitude precipitation since the mid-Twentieth Century. There is no place to go, to escape these effects, though their effects may be less severe in some places.

The result is the collapse of empires, and strong centralized large government functions, as has happened in the past, as was pointed out by Prof. Raymond Wheeler, of the University of Kansas, some time ago in his "Journal of Human Ecology."

No matter where you go, you cannot escape your geological environment of the Natural World, no matter what your level of arrogance, until you are dead.

Since you can't escape the power hungry, greedy politicians, I suggest buying survival books and developing survival skills.

Hmm, how are you doing with emergency power for your station, should the power go off? Has your club an emergency van or trailer ready? — Wayne. 73

Field Day Follies

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Zulus mixed up in it somehow, too, so it don't sound good."

With that, he turned and fled into the woods. I heard the car door again, and then the engine revving up, and the headlights knifed into the woods. Well, he forgot to turn around, so instead of heading back to the highway he drove straight into our clearing and pancaked into the sand pit.

They stayed locked in there for a good ten minutes before we could convince them that, in spite of my northern speech, we weren't Yankees or federals, and we didn't have any sinister x-ray machines, and we weren't after anybody's whiskey. But there was no way we could make them understand what a radio Field Day or a phonetic alphabet was.

Finally they came out, a fellow of about our own age, and a shy girl with the sweetest Dixie accent. So we got the generator gassed up again, and got some lights back on, and with all of us pulling, we got the car out rather easily. But when the lights caught the lovers, Denny and I nodded knowingly at each other. We had seen at the same moment that both the guy and the girl were wearing one black sock and one pink one. 73

Field Day 2000

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items such as coax, coaxial adapters, rope, tape, tools, etc.

• Keep fresh fuel in the generator. Use a fuel stabilizer if available.

• Run periodic "emergency" sessions.

XAR concluded that a few more exercises following a similar plan were deemed desirable in preparation for a "real" emergency. Next time, we'll do even better. 73

ON THE GO

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extremely important. We need you to be involved and, hopefully, letting you in on a few of the tips and techniques might make it just a little bit easier to get started. 73

Hamfest Loser

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No amount of tapping, probing, or tube checking would bring it back. Without a schematic, even the most powerful shamans I could summon were helpless. So it was to be the S-85 and the vertical.

I mounted the vertical, proud and tall, at the peak of the roof, and attempted to load my DX-20's fifty watts into it. It didn't seem to be taking power. No one was answering my calls. I borrowed an SWR meter: off the scale at ten-to-one. We tried redoing the connections, even an antenna tuner: no success. A few years later, the vertical long pulled down, I learned that a roof-mounted vertical needs radials to work at all; why hadn't somebody told me?

So I worked no 20-meter DX that winter, and my hamfest profits amounted to 10 cents. Just enough to buy another apple at the hamfest next year. It was a big, juicy, Delicious apple.

QRX

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DTV Update

According to news reports, lawmakers have warned broadcasters and consumer electronics makers that the government may step in to speed the move to digital television.

Television broadcasters are supposed to move from analog to digital by 2006, or when the penetration rate for televisions that can receive the high-definition signals reaches 85 percent, whichever comes later.

However, most regulators, lawmakers and industry representatives believe that deadline will slip by, because few consumers have bought the TV sets necessary to receive high-definition signals. Potential buyers have been discouraged by the high cost of digital receivers and televisions, and there is limited high-definition programming available.

But regulators say that digital must move forward at all cost. And according to Louisiana representative Billy Tauzin, who chairs the House Energy and Commerce Committee, he is considering the idea of imposing a hard deadline of 2006 to force everyone to work together to bring about the transition.

However, a hard deadline would be tied to assurances that consumers could purchase the necessary digital television receivers. And without them or at least very low cost converter boxes, there will be no transition to digital TV. At least not in the short term.

Thanks to David Black KB4KCH, via Newsline, *Bill Pasternak WA6ITF, editor.*

Cords Across America

By now, everyone has heard about the power crisis in California. And while that state's politicians argue as to how to keep the lights burning, one midwest radio personality has his own idea. Hello, Cords Across America.

Unless you live in the midwest, the name Randy Miller probably does not mean very much to you. But for those who love the Nashville sound, Young Country Q-104 is where they keep their dials set.

Q-104 is actually radio station KBEQ FM in Kansas City, Missouri. It also happens to be the on-air home of the sometimes irreverent morning man Randy Miller.

What Randy Miller wants to do is to plug in an electrical extension at KBEQ. Then, have someone a few feet to the west attach another wire to it. And then have someone else plug into that. The idea is to keep going until there is an extension cord that stretches the 1,300 miles from Kansas City to the California state capital.

OK. We all know that Miller's idea is probably nothing more than a fun radio promotion. Even if KBEQ could get the necessary federal and state waivers to permit an electrical extension cord to stretch from Kansas City to California, the amount of electricity available in Sacramento would probably not even light a 10 watt bulb. But you have to admit that the thought of thousands of ten- or twenty-foot extension cords across the Great Plains and climbing the Rocky Mountains would be fun to see.

Thanks to Cathy Anno KBØFDU, via Newsline, *Bill Pasternak WA6ITF, editor.*

NYC Blackout — 1965

The date was November 9, 1965. The place — the northeastern United States. And shortly after 5 p.m., the lights in New York City started to dim. Within three quarters of an hour, the city and the region were blacked out. While there have been many tales of what it was like to have been in the Big Apple when the lights went out, here's where you can find what perhaps is the best description yet: the blackout through the eyes, ears, and voice of one of America's best known radio air personalities of the time, Big Dan Ingram.

Ingram was on the air that afternoon doing his normal afternoon ride-time program when things started to go wrong at the station. Unaware that the power in the region was dropping away quite rapidly, Ingram continued his show until — well, hear it for yourself. A condensed aircheck of his program can be found in Real Audio on the [www.musicradio77.com] historic Web site. And after you listen, spend some time at [www.musicradio77.com], because it is a trip back through the golden days of Top 40 AM radio that we are not likely to ever hear again.

Thanks to Newsline, *Bill Pasternak WA6ITF, editor.*

Telephone Factoids

Have you ever wondered how many people actually have telephone service?

As of July 2000, 99.1 million households had telephone service. AT&T's share of interstate carrier toll revenues decreased from 90% in 1984 to 41% in 1999. This, while WorldCom's and Sprint's collective shares accounted for about 33% in 1999 and more than 700 smaller long distance carriers accounted for the remaining 26%.

High-speed data lines connecting homes and small businesses to the Internet with speeds of over 200 kilobytes per second in at least one direction increased by 57% during the first half of 2000. That accounted for a total of 4.3 million lines or wireless channels.

Last, the number of calls made from the United States to other countries increased from 200 million in 1980 to 5.2 billion in 1999. But on average, carriers billed only 51 cents per minute for international calls in 1999. That's 50% less than the rate charged in 1980.

Thanks to the CGC Communicator, *via Jeff Clark K8JAC, via* Newsline, *Bill Pasternak WA6ITF.*

Never Say Die

continued from page 4

Sibrel mentioned one other very strange coincidence. That was the retirement of NASA Administrator James Webb at 62, just a few months before the Apollo 11 flight. He had been the head of NASA since 1961 — during the entire program leading up to the fake flights. Then, instead of staying on a few more months and enjoying the results of his seven years of work, plus a lot of glory, he retired. Was he abandoning ship early just in case the hoax might be exposed?

Webb died in 1992, so we'll probably never know.

Miller

What ever happened to Don Miller W9WNV? I was asked that recently by a reader. Golly, I haven't heard from Don in years. With good behavior he should be getting out of prison soon.

Hey, I could talk about Don for an hour. He cut quite a swath in amateur radio in his day. But some of my editorials about his adventures made him mad and he sued me for interfering with his making money from DXers.

When Don got on the air from a couple of rare spots, he quickly discovered that

many of the hams on the ARRL's Honor Roll had no honor, and would pay plenty to make sure that they got credit for every new country that came on the air. So Don charged 'em $50 a country for a contact and card. If they didn't pay up front, he was unable to hear them when they called. Mind you, this was in the 1960s, when $50 was more like $500 or so today.

By operating from one rare country after another, Don had a steady stream of unreported to the IRS cash coming in the mail. He bragged to a ham I visited on Western Samoa that he was making over $50,000 a year with this scam.

Don was not dumb. When a well-known WØ got on the air from Morocco and pretended to be operating from one nearby African country after another, complete with QSL cards, Don got the hint. When the ARRL found out about the North African DX scam, they tightened up their authentication requirements. That didn't bother Don — he was just more creative in his forging of official documents.

Don called me one day, wondering if I might be interested in going with him on a DXpeditioning trip to the Indian Ocean area. Well, I was, until he explained what he was going to do. His plan was to operate from a bunch of rare Indian Ocean spots, but to never actually be where he said he was. No, thanks.

A couple years later, I visited Burma — I had a card from working Don there — only to find out from a local ham that Don had never really been there. The word was that he went on the air from northern Thailand, pretending to be operating from Burma, Vietnam, Laos, and Spratley Islands. I worked him in all those spots and had the cards.

When I exposed his scam, he sued me for damaging his income from his DXpeditions. Fortunately I was insured, so that didn't cost me anything.

But that apparently put him out of the DXpedition business. Being an MD, he looked around for something new to do, and settled on opening medical businesses to tap the Medicare millions. In 1982, he went to prison for 25-to-life for paying a janitor $5,000 to kill his wife and burn the medical building for the insurance. He may already be out of prison and cooking up something new. I wonder if he'll want to get his old call back. If you run into Don, maybe you can talk him into doing a series for *73* on his DXing exploits. It would make great reading.

Near-Death Experience

Continental Airlines came tha-a-at close to killing me. What a bummer. I've been flying on commercial airline flights since 1927, and this is the first time anything life-threatening has happened.

Sherry and I were flying from Boston to Lisbon. Usually, a good ham friend of mine who works for Continental is able to bump us up to first class, giving us much more comfortable seats, but the airline stopped that nonsense, so we made the flight crammed into the economy-class seats. That's not a problem for Sherry, but I'm about six feet tall, so finding a place for my longer legs is an uncomfortable challenge.

I did the best I could, but when the stewardess woke me for arrival, I found that my right leg had gone totally to sleep. It had no feeling, other than it hurt like hell. I tried to exercise it to get the blood circulating, but there was no noticeable improvement.

When we landed I hobbled off the plane on my left leg. Intense pain. It was two days before I was able to walk more than a few feet. Months later I could still feel some discomfort. It sure ruined our visit to Portugal.

What I didn't know then was that deep-vein thrombosis (DVT) is a fairly common problem, with around 800,000 people a year being hospitalized, of which about 200,000 have a pulmonary embolism and die. Lousy odds.

A blood clot forms in the leg. When it breaks loose it zips up to the lungs, which stops you from breathing. Lights out. I wonder if the airlines ship the bodies home free of charge ...?

If I'd been a smoker or overweight, I probably would be just another statistic now. Fortunately, I was in good physical shape, so I survived.

Mad With Desire!

The new Ramsey catalog arrived, giving me all kinds of ideas for developing small businesses. Just what I need, another business.

Many years ago, I recommended that hams consider the security business. Hey, we're electronic experts, right? Well, we were then, at any rate. Several readers liked the idea and have built multi-million-dollar security businesses as a result.

Just about every business has a need for some sort of security protection. When I bought a Peterborough motel and turned the rooms into offices and a computer software development lab where the restaurant had been, I put switches on all the doors and hooked them to a small transmitter. That way, at night I'd hear a tone a mile away at my home anytime anyone opened a door.

Sure enough, one night the signal woke me up. I called the Peterborough police and they caught two guys who had broken in and were about to steal some computers from the lab. It was an exciting night for the burglars, the police, and me.

Ramsey has AM and FM transmitter kits, low- and medium-power; TV transmitters, hi-fi stuff, video — there's just too many brain-watering gadgets, and all quite modestly priced. If this array of great stuff doesn't get your brain going, you need a deep brain enema to clear out the constipation.

Power supplies, test equipment, learning kits, weather stations, car audio, high-end audio, mini-kits, motion detector, fox-hunting, rocket tracking, etc. Ramsey, 793 Canning Parkway, Victor NY 14564, [www.ramseykits.com].

Hmm, just what I've been looking for, right there on page 6, and only $120 ready to use — a mini mixer. Well, I've been wanting to make some audio tapes and be able to have some music gemixt. I want to do one on the day Khrushchev saved amateur radio. And another on the greatest disaster in the history of the hobby.

And then there's that $120 Minox-size digital camera on page 8 that can shoot 360 pictures that I can download into my iMac DV! Hmmmm.

End Your Pain

Money isn't everything. It can buy sex, but not love. It can often cause pain and suffering. I'm telling you this because I am your friend and I want to do my best to take your pain and suffering away.

So, just send me all your money and I will suffer for you. Cash only, please. Your caring friend, Wayne.

CW vs. Phone

With countries all around the world dumping the Morse Code test, perhaps it's time the ARRL pushed the ITU to erase that requirement from the international rules.

But, what would we replace this obstacle with, you ask? Clearly, we have to have some sort of bar to keep just anyone from getting a ham ticket. The code test successfully kept millions of interested potential hams at bay, thus achieving the goal set by the ARRL when it got the FCC to increase the code speed required for licenses.

So, what other operating skill might we substitute for the code barrier? We don't want to open the flood gates and crowd up our bands again, right? Well, I have a suggestion (you knew I would).

Just as the Morse Code barrier was set up back when over 90% of ham

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Jim Gray II
210 East Chateau Circle
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[akdhc2pilot@yahoo.com]

Happy Solstice!

We are now approaching the summer "doldrums," when ionospheric absorption and atmospheric noise reach their peak, adversely affecting the whole HF spectrum. Fortunately, we are also riding the crest of Sunspot Cycle 23, so decent worldwide DX should be available most anytime on at least one of the bands.

Overall, expect afternoon over-ionization to weaken signals on ten through twenty meters, and atmospheric noise to limit nighttime activity on thirty meters and above. Early mornings, late afternoons, and evenings will be the most fruitful hours, but sporadic-E can unexpectedly liven things up almost anytime, so don't ignore this possibility when looking at the charts. When propagation on the HF bands is so poor that you can't even manage a domestic contact, just tune up your VHF rig and enjoy the excellent seasonal conditions available there.

As far as solar activity is concerned, June should be mostly quiet despite numerous sunspots and high solar flux. My calculations indicate that the daily planetary geomagnetic index (Boulder-A) will be fairly low for two-thirds of the month. When the Boulder-A index is low and the solar flux index is high, we typically experience better than average propagation conditions.

Nonetheless, I'm forecasting that the 11th through the 18th will be very unsettled, with a high potential for strong solar flares or CMEs during the period. When ejecta from these events is directed toward earth, we experience a geomagnetic storm. Depending on the density of heavy particles in the solar stream, effects can range from temporary shortwave fadeouts to catastrophic failures in the electrical power distribution grid.

To stay on top of current solar conditions, trends, and forecasts be sure to monitor WWV at 18 minutes past each hour or visit the Space Environment Center Web site at [http://www.sel.noaa.gov/radio].

Happy solstice, and good DXing to all!

June 2001						
SUN	MON	TUE	WED	THU	FRI	SAT
					1 F	2 F-G
3 G	4 G	5 F	6 F-P	7 F-G	8 G	9 F-P
10 F	11 F	12 F-P	13 F-P	14 F-P	15 P	16 VP
17 P	18 F-P	19 F-G	20 G	21 G	22 F-G	23 F
24 F-G	25 G	26 F-G	27 G	28 G	29 G	30 P

EASTERN UNITED STATES TO:												
GMT	00	02	04	06	08	10	12	14	16	18	20	22
Central America	15-20	(15) 30	20 (40)	(20-40)	x	(20)	20	(20)	(15)	(15)	15 (20)	(10) 17
South America	15 (20)	(15) 20	20 (40)	(20-40)	(20)	x	(15)	(15)	x	(10)	(10-20)	(10) 20
Western Europe	20	20	(20-40)	(40)	x	(20)	x	x	x	x	(20)	20
South Africa	x	(40)	x	(20)	x	x	x	x	(15)	(15)	x	x
Eastern Europe	20	20 (40)	(20)	x	x	x	(20)	x	x	(15)	(15)	(20)
Middle East	20	20 (40)	(20)	x	x	x	x	x	x	x	(20)	(15)
India/ Pakistan	(15-20)	(20)	x	x	(20)	x	x	x	x	x	x	x
Far East/ Japan	(15)	x	x	x	x	x	(20)	(15-20)	(15)	x	x	(15)
Southeast Asia	(15-20)	x	x	(20)	x	x	(20)	x	x	(15)	x	x
Australia	(15)	(15)	x	x	(20-30)	(20-30)	(20)	(20)	x	x	x	x
Alaska	(15-20)	(15-20)	(15-20)	20	20 (40)	(20-40)	(20)	(20)	x	x	(15)	(15-20)
Hawaii	(15-20)	(15-20)	(15-20)	20	20 (40)	(20-40)	(20)	(20)	x	x	x	(15)
Western USA	(10) 30	(10) 30	(10) 40	(15) 40	(20) 40	(20-40)	(15) 20	(10) 20	(10-20)	(10-20)	(10-20)	(10) 20
CENTRAL UNITED STATES TO:												
Central America	(10) 20	(15) 30	20 (40)	20 (40)	(20-40)	(20)	(20)	(15) 20	(15-20)	(10-20)	(10-20)	(10) 17
South America	10 (20)	(10) 20	(15) 30	(15) 30	(20-40)	(20)	(20)	(15)	(15)	(10)	(10-15)	(10-20)
Western Europe	(15) 20	20	(20-40)	(20-40)	x	(20)	(20)	x	x	x	x	(15-20)
South Africa	x	x	(40)	(20-40)	(20)	x	x	x	(10-15)	(10-20)	(20)	x
Eastern Europe	(20)	(20)	(20)	(20)	x	x	(20)	(20)	x	(15)	(15-20)	(15-20)
Middle East	(15-20)	(20)	(20)	(20)	x	x	x	x	x	x	(20)	(20)
India/ Pakistan	(15-20)	(15-20)	(20)	x	x	x	(20)	x	x	x	x	x
Far East/ Japan	x	(15)	(15)	x	x	(20-40)	(20)	20	(20)	x	x	x
Southeast Asia	(15)	(15)	(15-20)	(20)	x	x	(20)	(20)	(15-20)	(15)	(15)	x
Australia	(15)	(15)	(15)	(20)	20 (40)	(20-40)	(20-40)	20	(20)	x	(15)	x
Alaska	(10) 30	(10) 30	(10) 40	(15) 40	(20) 40	(20) 40	(20-40)	(15-40)	(10) 30	(10-20)	(10-20)	(10) 20
Hawaii	(15-20)	15 (20)	(15-20)	20	20	(20)	20	(20)	x	x	x	(15)
WESTERN UNITED STATES TO:												
Central America	(10) 17	(15) 20	(15) 20	20	(20)	(20)	(20)	(20)	(20)	(10-20)	(10-15)	(15-20)
South America	(10-20)	(10) 17	15-20	(15) 20	(20)	(20)	(20)	(15)	(15)	x	(15)	(10-15)
Western Europe	(15-20)	(20)	20	(20)	x	x	x	(20)	(15)	(15)	(20)	(15-20)
South Africa	x	x	x	(20)	(20)	x	x	(20)	(20)	(15)	x	x
Eastern Europe	(15-20)	(20)	(20)	(20)	x	x	x	(20)	x	x	x	(15-20)
Middle East	(20)	(15-20)	(15-20)	(20)	x	x	x	x	x	x	x	(20)
India/ Pakistan	x	x	(15)	x	x	x	x	(20)	x	(15)	x	x
Far East/ Japan	(15)	(15)	(20)	(20)	(20)	(20-40)	(20-40)	(20)	(20)	(15-20)	x	(15)
Southeast Asia	x	x	(15)	(15)	x	(20)	(20)	(20)	(15-20)	(15-20)	(15)	x
Australia	(10-15)	(10-15)	15	(15-20)	20	20	20	(20)	20	(20)	x	(15)
Alaska	(10) 40	(10) 40	(10) 40	(15) 40	(20) 40	(20) 40	(20-40)	20-40	(15) 40	(10) 40	(10) 40	(10) 40
Hawaii	(10-15)	(10-20)	(10-20)	(15-20)	20	20	(20-40)	20 (40)	(20-40)	x	x	(10-15)
Eastern USA	(10) 30	(10) 30	(10) 40	(15) 40	(20) 40	(20) 40	(20-40)	(15-20)	(10) 20	(10-20)	(10-20)	(10) 20

Table 1. Band, time, country chart. Plain numerals indicate bands which should be workable on Fair to Good (F-G) and Good (G) days. Numbers in parentheses indicate bands usually workable on Good (G) days only. Dual numbers indicate that the intervening bands should also be usable. When one number appears in parentheses, that end of the range will probably be open on Good (G) days only.

Band-by-Band Summary

10 and 12 meters

Daytime absorption can drastically weaken signals, but good DX conditions may still be found on paths to the Caribbean and Latin America, with occasional openings to Africa and Australia. Expect signals to peak during local afternoon, but look for brief sporadic-E openings anytime through late evening. Short-skip will be between 1,000 and 2,000 miles.

15 and 17 meters

Good DX should be available to many parts of the world, with maximum signal strength occurring in the late afternoon. Long summer days in the northern hemisphere will allow these bands to be worked well into the evening on good (G) days. Look for short-skip up to 2,300 miles.

20 meters

Good worldwide communications will be possible, with the strongest daytime signals occurring shortly after sunrise or in the late afternoon and early evening hours. Nighttime DX will be quite good, especially to the west and northwest. Short-skip will be between 500 and 2,000 miles during the day and from 1,000 to 2,300 miles at night.

30 and 40 meters

Good DX is likely to be heard throughout the night as long as atmospheric noise isn't too great, but static from thunderstorms will undoubtedly intensify as the month progresses. Daytime openings may be possible, particularly between the coasts or to Alaska, but skip will be limited to 750 miles or so. At night, skip will fluctuate from 500 to over 2,000 miles.

80 and 160 meters

High static will mask signals on these bands most of the time, but occasional weak openings may occur between sunset and sunrise. Peaks will usually come near midnight and in the predawn hours. Short-skip will vary from 1,000 to 2,000 miles. 73

NEVER SAY DIE

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communications was taking place via CW, how about a speaking test, now that 90% of ham communications are on voice?

The code test was, of course totally unnecessary in the past. If you didn't know the code you couldn't contact anyone, so everyone had to learn it to make any contacts. Today, though everyone knows how to speak, very few seem to have a clue when it comes to actually communicating.

Instead of our volunteer examiners testing for code recognition, how about their entering into a mock-up contact as part of the test? The applicant would then have to demonstrate an ability to enter into an actual conversation with the examiner, and not just a recitation of the equipment and antenna being used, or the weather.

Well, maybe we should allow the weather, elst around 90% of the guys I'm hearing on the air would never pass the test.

When I was ten I went to school in Washington DC and we had a daily mock radio announcer session for everyone. They had a microphone set up and each of us had to read a selected news item from the newspaper. That had us reading the papers every night, looking for unusual items to read the next day. We had to have a backup, just in case someone else picked the same subject and got to the mike first.

This helped make us more aware of current events, and to get over our fear of speaking in front of a group.

Now, when you go on the air, do you have anything interesting to talk about on hand? A news item? Something from a magazine? Like maybe my editorial essays?

We've been greatly hobbled because we've never bothered to develop duplex systems. I remember some wonderful contacts back in the 1930s where a bunch of us would get together on 160m, each rebroadcasting someone else from the high to the low end of the band, or the reverse. In that way, a half dozen or more of us could hear each other through the network. That was a whole different kind of ham radio, and one I dearly miss.

We can do that today if we use low-power rigs on different ends of a band, with separate transmitters and receivers. Or work crossband. Or, much better, develop a time-sharing system on one frequency.

How about getting started on 2m with two receivers at the repeater. We'd have to use headphones to keep from getting feedback, but at least we'd be able to talk with each other without having to say, "Over..." Then we could add a third and fourth receiver, all tuned to different inputs, at the repeater. C'mon, guys.

The Club

Poor old Wayne, he's obviously lost his marbles. He sees conspiracies everywhere. What a nut case!

No, I have not lost my marbles. I still have them in a box out in the barn, left over from childhood.

And I don't buy into conspiracies without overwhelming evidence of a scam.

In this case, it's Congress. You know, the outfit that we rubes are unable to keep ourselves from re-electing over 98% of the time. Yeah, we really are rubes.

We've all watched wrestling and enjoyed it. Sure, most of us know it's phony baloney. It's a live performance for our amusement. But there are some rubes out there who just don't want to believe that it's all acting. Carefully rehearsed acting.

Well, it's the same with the Big Show in Washington. The Republicans and Democrats have at it in both the House and the Senate, calling each other insulting names and fighting over a few billion for this bill or that. And then they have lunch together, laughing over the day's performance for us rubes.

Clearly the "work" pays well, with senators spending an average of over $4 million to get re-elected every six years.

Washington is about power, not ideology. The show is to keep the money rolling in from the rubes to the RNC and the DNC. The last election extravaganza cost over $3 billion. That's peanuts compared to the prize money they get to spend — the $2 trillion budget (that's not counting even more trillions off-budget). That's $2,000 billion! And my, does the pork fly. Who says pigs can't fly? Powered by lobbyist money, almost anything is possible, even flying pork.

Hey, rube! How about getting off your turnip truck the next time around?

Brain Drain

Our bodies are 70% water and our brains, 85% water. So make a quick wild guess as to what part of the body will be the most effected when you dehydrate your cells.

For the average person anything less than a half gallon of water a day means cells are being dehydrated. That's why experts in the field are recommending that we drink at least eight glasses of water a day. But, if you've dehydrated your cells for years, the way I have, then the smart thing to do is to rehydrate. So I'm drinking at least 12 glasses a day. Dr. Lorraine Day, when she was totally curing herself of a huge breast cancer, drank 20 glasses a day.

And that's pure water, not that sewage coming out of your tap. Distilling your water is best. That'll get rid of the chlorine, fluorides, and anything else that can cause you problems.

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NEVER SAY DIE

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Is there any connection between our dehydrating ourselves and brain problems such as Parkinson's and Alzheimer's? I'd sure be surprised if there wasn't.

No, drinking coffee and tea does not count as water. Nor does beer or wine. Nor milk. Water means water. Cool, clear, water.

Duh

When the average SAT math scores dropped from 500 to 424, the College Board responded by allowing the use of calculators. When that didn't help, they just added 20 points to all the math scores to jack them back up a bit — and 80 points to the, like, ya know, those ... er ... uh ... verbal scores, for a total boost of 100 points. Well, they didn't want the students to feel badly about themselves. Hey, self-esteem is far more important than any actual education.

Also, I see where some colleges are dropping their use of the SAT scores. The estimate is that last year parents poured over $100 million into coaching for the SAT exams. This might be okay if the stuff the SATs test for had any serious relevance to our personal lives or careers. But what a waste of time and money teaching kids to get a better mark on a test!

Worse, the SATs are for most colleges the key to entry. By now, I hope you know what a ghastly waste of time and money a college "education" is. A contradiction of terms.

One of the main reasons for colleges dropping the SAT barrier to entry is that they want to attract more minority students, and blacks are scoring an average of 198 points lower than whites on the test.

Space Travel

One of the problems we'll face when we want to venture farther out in space than near-Earth orbit is protection from radiation. The government agrees that the maximum lifetime dose is 25 rads and that death always begins after 500 rads. So, how much radiation can we expect to encounter while traveling beyond the present low Earth orbits of our satellites and space stations, on out through the Van Allen Belt? At the speed of today's rockets (6.8 miles/sec.), while traveling through the inner Van Allen Belt, which is about 25,000 miles wide, we would expect an exposure of 1,800 rads. It's going to take quite a lot of shielding for any living thing to survive that.

Then, there's the radiation in space coming from Sun flares. This is the intense radiation that keeps the Van Allen Belt charged. It's estimated that there must be a minimum average of 0.32 rads per second in space. That would dose any spacefarers with about 270 rads per day once beyond the Van Allen Belt.

With Joe Firmage said to be planning on building a space hotel which would take tourists on trips around the Moon and then back to an Earth orbit, I wonder how it will be possible to protect his customers from the radiation hazards.

Please advise.

Leukemia

While almost everyone puts their trust in their doctor rather than make any effort to learn about their illness, it is gratifying to get letters from readers who have successfully defied the system. A note from one reader, who was diagnosed with chronic lymphocytis leukemia, and was "treated" with Cytoxan (cyclophosphamide), which did no good.

When he did some investigating, he found that the stuff is used for insect sterilization and experiments in chemical sheep shearing. That did it for him as far as chemotherapy was concerned, infuriating his doctor, who refused to "treat" him further. He then started using the bioelectrifier, along with some herbs and vitamins, and after six weeks he found that his lymphocytes, which had been around 400,000 cells per microliter (normal range: 800–4,000) and had invaded his bone marrow, were down to 7,000 cells per microliter.

I've written about Dr. Lorraine Day, who had "incurable" breast cancer. She's now totally cured. If you know anyone who has cancer, please get them to read my *Secret Guide to Health* and also get Dr. Day's video, *Cancer Doesn't Scare Me Anymore* (800-574-2437, and say hello from Wayne).

I've also explained about Dr. Henry Bieler's book, *The Incurables,* where he went into hospitals and treated children left there to die with incurable leukemia, and cured 100% of them by taking them off all milk products and giving them minced raw liver. Our bodies need protein, and they're designed to deal with raw meat, not cooked.

Okay, I've put down my stethoscope. For now.

Instant Surgery

Have you read about London's famous Dr. Robert Liston? Well, yes, this was 150 years ago, before Lister, but Dr. Liston set an all-time record when he amputated a man's leg in two and a half minutes (the poor guy died later of gangrene). He also managed to amputate two fingers from his assistant (who also died later of gangrene), plus he sliced through the coattails of a distinguished surgical spectator, who was so frightened that he'd been cut open that he died from fright. That's the only operation in history with a 300 percent mortality rate.

Those Bras

Could bras be killing women? In a recent study of 4,700 women, those who never wore bras had the same incidence of breast cancer as men: very rare. Women who wear bras 24 hours a day are 125 times more likely to develop cancer as women who don't. And those who wore bras more than 12 hours a day but didn't sleep in them had only 21 times the risk.

This was reported by Dr. William Douglass in his *Second Opinion* newsletter, which I've recommended in my *Secret Guide to Wisdom.*

It's interesting that this research was reported to the National Cancer Institute, the American Cancer Society, the National Organization for Women, and many more women's organizations. None responded!

When Dr. Sydney Singer first reported his discovery of the bra-cancer connection five years ago, he was laughed at by the "experts." This new study has lawyers all excited.

You can read Dr. Singer's 1995 book, *Dressed to Kill,* Avery, $12, for the details and references backing him up.

Laughing

It's no news flash that stress is a killer, yet we put up with stress, as we do with more and more slow killers we now know about (like refined sugar).

In an experiment, researchers at Ohio State University injected eight rabbits with large amounts of cholesterol. Eventually seven of the rabbits had heart attacks and died. But one was still alive and healthy. It took a while for them to find out what had made the difference. It turned out to be a lab assistant who had picked up that rabbit and stroked it every day.

Maybe you're familiar with how Norman Cousins cured himself of a rare and deadly blood disease by renting movie comedies and reading humorous books. My favorites are the Dilbert books.

The reverse is true. If you are under stress at work or at home, that's going to knock down your immune system and you're going to be much more susceptible to health problems. Like cancer, heart attacks, stroke, and so on.

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Wise Up!

Here are some of my books which can change your life (if you'll let 'em). If the idea of being healthy, wealthy and wise interests you, start reading. Yes, you can be all that, but only when you know the secrets which I've spent a lifetime uncovering.

.....Wayne

The Secret Guide to Health: Yes, there really is a secret to regaining your health and adding 30 to 60 years of healthy living to your life. The answer is simple, but it means making some serious lifestyle changes. Will you be skiing the slopes of Aspen with me when you're 90 or doddering around a nursing home? Or pushing up daisies? No, I'm not selling any health products, but I can help you cure yourself of cancer, heart trouble, or any other illness. Get this new, 2001 expanded edition (156p). $10 (#05)

The Secret Guide to Wealth: Just as with health, you'll find that you have been brainwashed by "the system" into a pattern of life that will keep you from ever making much money and having the freedom to travel and do what you want. I explain how anyone can get a dream job with no college, no résumé, and even without any experience. I explain how you can get someone to happily pay you to learn what you need to know to start your own business. $5 (#03)

The Secret Guide to Wisdom: This is a review of around a hundred books that will boggle your mind and help you change your life. No, I don't sell these books. They're on a wide range of subjects and will help to make you a very interesting person. Wait'll you see some of the gems you've missed reading. You'll have plenty of fascinating stuff to talk about on the air. $5 (#02)

The Bioelectrifier Handbook: This explains how to build or buy ($155) a little electrical gadget that can help clean your blood of any virus, microbe, parasite, fungus or yeast. The process was discovered by scientists at the Albert Einstein College of Medicine, quickly patented, and hushed up. It's curing AIDS, hepatitis C, and a bunch of other serious illnesses. It's working miracles! The circuit can be built for under $20 from the instructions in the book. $10 (#01)

My WWII Submarine Adventures: Yes, I spent from 1943-1945 on a submarine, right in the middle of the war with Japan. We almost got sunk several times, and twice I was in the right place at the right time to save the boat. What's it really like to be depth charged? And what's the daily life aboard a submarine like? How about the Amelia Earhart inside story? If you're near Mobile, please visit the Drum. $5 (#10)

Wayne's Caribbean Adventures: My super budget travel stories – where I visit the hams and scuba dive most of the islands of the Caribbean. You'll love the special Liat fare which let me visit 11 countries in 21 days, diving all but one of the islands, Guadeloupe, where the hams kept me too busy with parties. $5 (#12)

Cold Fusion Overview: This is both a brief history of cold fusion, which I predict will be one of the largest industries in the world in the 21st century, plus a simple explanation of how and why it works. This new field is going to generate a whole new bunch of billionaires, just as the personal computer industry did. $5 (#20)

Cold Fusion Journal: They laughed when I predicted the PC industry growth in 1975. PCs are now the third largest industry in the world. The cold fusion ground floor is still wide open, but then that might mean giving up watching ball games. Sample: $10 (#22).

Julian Schwinger: A Nobel laureate's talk about cold fusion—confirming its validity. $2 (#24)

Improving State Government: Here are 24 ways that state governments can cut expenses enormously, while providing far better service. I explain how any government bureau or department can be gotten to cut it's expenses by at least 50% in three years and do it cooperatively and enthusiastically. I explain how, by applying a new technology, the state can make it possible to provide all needed services without having to levy *any* taxes at all! Read the book, run for your legislature, and let's get busy making this country work like its founders wanted it to. Don't leave this for "someone else" to do. $5 (#30)

Mankind's Extinction Predictions: If any one of the experts who have written books predicting a soon-to-come catastrophe which will virtually wipe most of us out are right, we're in trouble. In this book I explain about the various disaster scenarios, like Nostradamus, who says the poles will soon shift (as they have several times in the past), wiping out 97% of mankind. Okay, so he's made a long string of past lucky guesses. The worst part of these predictions is the accuracy record of some of the experts. Will it be a pole shift, a new ice age, a massive solar flare, a comet or asteroid, a bioterrorist attack? I'm getting ready, how about you? $5 (#31)

Moondoggle: After reading René's book, *NASA Mooned America*, I read everything I could find on our Moon landings. I watched the NASA videos, looked carefully at the photos, read the astronaut's biographies, and talked with some readers who worked for NASA. This book cites 45 good reasons I believe the whole Apollo program had to have been faked. $5 (#32)

Classical Music Guide: A list of 100 CDs which will provide you with an outstanding collection of the finest classical music ever written. This is what you need to help you reduce stress. Classical music also raises youngster's IQs, helps plants grow faster, and will make you healthier. Just wait'll you hear some of Gotschalk's fabulous music! $5 (#33)

The Radar Coverup: Is police radar dangerous? Ross Adey K6UI, a world authority, confirms the dangers of radio and magnetic fields, including our HTs and cell phones. $3 (#34)

Three Gatto Talks: A prize-winning teacher explains what's wrong with American schools and why our kids are not being educated. Why are Swedish youngsters, who start school at 7 years of age, leaving our kids in the dust? Our kids are intentionally being dumbed down by our school system — the least effective and most expensive in the world. $5 (#35)

Aspartame: a.k.a. NutraSweet, the stuff in diet drinks, etc., can cause all kinds of serious health problems. Multiple sclerosis, for one. Read all about it, two pamphlets for a buck. (#38)

$1 Million Sales Video: The secret of how you can generate an extra million dollars in sales just by using PR. This will be one of the best investments you or your business will ever make. $40 (#52)

Reprints of My Editorials from *73*. Very few things in this world are as we've been taught, and as they appear. I blow the whistle on the scams around us, such as the health care, our school system, our money, the drug war, a college education, sugar, the food giants, our unhealthy food, fluorides, EMFs, NutraSweet, etc.

1996 Editorials: 120 pages, 100 choice editorials. $10 (#72)

1997 Editorials: 148 fun-packed pages. 216 editorials. $10 (#74)

1998 Editorials: 168 pages that'll give you lots of controversial things to talk about on the air. $10 (#75)

1999 Editorials: 132 pages of ideas, book reviews, health, education, and anything else I think you ought to know about. $10 (#76)

2000 Editorials: 76 pages (thinner magazine as a result of our slowly dying hobby). $5 (#77)

Silver Wire: With two 5-in. pieces of heavy pure silver wire + three 9V batteries you can make a thousand dollars worth of silver colloid. What do you do with it? It does what the antibiotics do, but germs can't adapt to it. Use it to get rid of germs on food, for skin fungus, warts, and even to drink. Read some books on the uses of silver colloid, it's like magic. $15 (#80)

Colloid Reprint. April 97 article on a silver colloid maker, history, and how to use the stuff. $5 (#98).

Colloid Kit. Three 9V battery clips, 2 aligator clips & instructions. $5 (#99).

Wayne's Bell Saver Kit. The cable and instructions enabling you to inexpensively tape Art Bell W6OBB's nightly 5-hr radio talk show. $5 (#83)

NH Reform Party Keynote Speech. It wow'd 'em when I laid out plans for NH in 2020, with much better, yet lower cost schools, zero state taxes, far better health care, a more responsive state government, etc. $1 (#85)

Stuff I didn't write, but you need:

NASA Mooned America: René makes an air-tight case that NASA faked the Moon landings. This book will convince even you. $30 (#90)

Last Skeptic of Science: This is René's book where he debunks a bunch of accepted scientific beliefs – such as the ice ages, the Earth being a magnet, the Moon causing the tides, and etc. $30 (#91)

Dark Moon: 568 pages of carefully researched proof that the Apollo Moon landings were a hoax—a capping blow for René's skeptics. $35 (#92)

Dark Moon Video: 222-minute exposé nailing NASA with their own photos. If you've watched the NASA films of the astronauts walking on the Moon you wondered at their weird gate. Wait'll you see it speeded up. It looks exactly like they're running on Earth! They catch NASA in dozens of give aways that the photos and films had to have been faked. $46 (#93)

Travel Diaries: You can travel amazingly inexpensively – once you know the ropes. Enjoy Sherry and my budget visits to Europe, Russia, and a bunch of other interesting places. How about a first class flight to Munich, a rented Audi, driving to visit Vienna, Krakow in Poland (and the famous salt mines), Prague, back to Munich, and the first class flight home for two, all for under $1,000. Yes, when you know how you can travel inexpensively, and still stay in first class hotels. $5 (#11)

73 Writer's Guide: It's easy, fun, can pad your résumé, and impress the hell out of your friends. $0 (#78)

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16

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Barter 'n' Buy

Turn your old ham and computer gear into cash now. Sure, you can wait for a hamfest to try and dump it, but you know you'll get a far more realistic price if you have it out where 100,000 active ham potential buyers can see it, rather than the few hundred local hams who come by a flea market table. Check your attic, garage, cellar and closet shelves and get cash for your ham and computer gear before it's too old to sell. You know you're not going to use it again, so why leave it for your widow to throw out? That stuff isn't getting any younger!

The *73* Flea Market, Barter 'n' Buy, costs you peanuts (almost)— comes to 35 cents a word for individual (noncommercial!) ads and $1.00 a word for commercial ads. Don't plan on telling a long story. Use abbreviations, cram it in. But be honest. There are plenty of hams who love to fix things, so if it doesn't work, say so.

Make your list, count the words, including your call, address and phone number. Include a check or your credit card number and expiration. If you're placing a commercial ad, include an additional phone number, separate from your ad.

This is a monthly magazine, not a daily newspaper, so figure a couple months before the action starts; then be prepared. If you get too many calls, you priced it low. If you don't get many calls, too high.

So get busy. Blow the dust off, check everything out, make sure it still works right and maybe you can help make a ham newcomer or retired old timer happy with that rig you're not using now. Or you might get busy on your computer and put together a list of small gear/parts to send to those interested?

Send your ads and payment to: *73 Magazine*, Barter 'n' Buy, 70 Hancock Rd., Peterborough NH 03458 and get set for the phone calls. The deadline for the August 2001 classified ad section is June 10, 2001.

NEVER SAY DIE

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So, get out there and enjoy the sunsets. Laugh at Jackie Chan and his choreographed martial arts antics. Let it out when you read the Dilbert cartoons. Check the humor section of my *Secret Guide to Wisdom.*

I laugh a lot. If you've ever heard me on with Art Bell you know that I laugh all through the show.

Summer!

Magazine deadlines being what they are, I'm writing this in mid-April. The snow in the front yard is down to a foot deep from six feet just a few days ago. It's mud season on the road going by the farm. But it won't be long before I'll be snapping digital pictures of the twenty-plus varieties of wildflowers in the north pasture. I plan to post them on my Web site (www.waynegreen.com) for readers who live too far away to walk the pasture with me enjoy the incredible beauty. One week, it's zillions of buttercups. A couple weeks later, it's millions of daisies. Bring your wildflower book and a camera.

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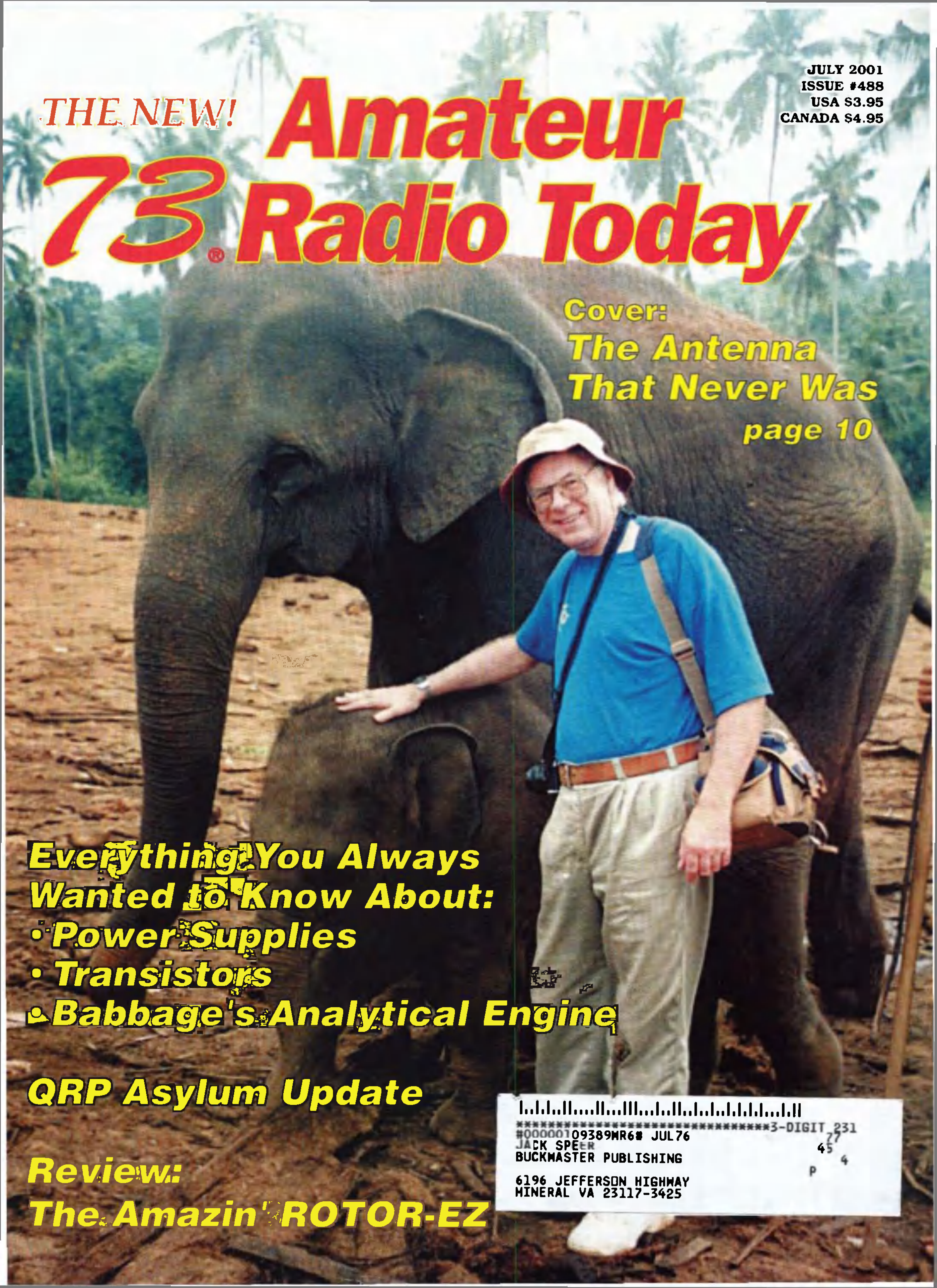
THE NEW!

73 Amateur Radio Today



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Everything You Always Wanted to Know About:
- Power Supplies
- Transistors
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QRP Asylum Update

Review:
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THE NEW!

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Ham Radio In Space: Tito Comes Home

Dennis Tito KG6FZX and two companion Russian cosmonauts landed on May 5th at 05:41 UTC near Astana, Kazakhstan. On landing, the ham radio space traveler was quoted as saying his stay on the International Space Station was a personal experience that went well beyond his dreams.

Tito, who reportedly paid the Russians $20 million for the flight, and his fellow flyers Talgat Musabayev and Yuri Baturin were each given an apple. The apple is a national symbol in Kazakhstan and is traditionally presented to cosmonauts returning from space.

During his visit, KG6FZX was hosted by Russian commander Yury Usachev UA9AD, along with U.S. astronauts Susan Helms KC7NHZ and Jim Voss. But Tito's voyage to the ISS is not without continued controversy. Former U.S. senator and astronaut John Glenn, who himself returned to space at age 77, told the Cable News Network on Saturday the 5th that he believed Tito's trip was a misuse of the spacecraft. This, because Glenn believes that the ISS is supposed to be for research.

But Yuri Semyonov, whose RSS Energiya corporation built Russia's segments of the ISS, says that his nation is satisfied with this flight. And rumors continue

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Wise Up & Beat the Odds

NEVER SAY DIE

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www.waynegreen.com

Yeah, More Mooning

But not much more. Last month I mentioned NASA spokesman Brain Welch, but I didn't give you the gory details. He's the NASA representative who was on the Fox TV show which questioned the Moon landings back in February, and was repeated in March. Too bad if you missed this one. Now here's the rest of the story.

If you watched the show you know that Welch had no answers to the many questions raised by René, Bill Kaysing, and John Percy. His only answer was a defiant, "We went to the Moon and anyone who doesn't believe it is a nut case."

After the program was filmed, Welch went back to NASA, complaining that he was really embarrassed at not having any good answers for the questions raised, and that, by God, he was damned well going to get some answers. Two days later he died, at 42. Heart attack.

I did mention astronaut John Irwin, who had called Bill Kaysing on a Tuesday, explaining that he had become a born-again Christian and wanted to get together with him Thursday to ease his conscience. He died Wednesday. Another timely heart attack.

Just a coincidence, of course — like the death of the eleven astronauts in the few months back in 1967 when they would have had to agree to go along with the hoax.

I've got to stop making so much of these coincidences.

Birthdays

Mine's September 3rd, so naturally I looked through Rod McKuen's Birthday Book to see who else was born on my birthday. If there's anything to astrology, those people should be a lot like me, right? Well, sharing my birthday, according to Rod, are Hank Thompson, Charlie Sheen, Alan Ladd, Kitty Carlisle, Steve Boros, Freddy King, Valerie Perrine, Ferdinand Porsche, and Dixie Lee Ray.

Clearly proving that there's not much to astrology.

Ferdinand Porsche is the guy who designed the original VW bug. And then, later, the cars bearing his name. For a while I was buying Porsches every year or so, but I got over it. The old Porsche Speedster was the most fun car I've ever had. I'll bet I put over a hundred thousand miles on it, just on car rallies. My Jaguar was the most trouble, by a very wide margin. I love the look of the new bugs and their colors knock me out. I'm glad to see other car makers like Ford quickly imitating this new bug look.

Dixie Lee Ray was the governor of Washington, chairman of the Atomic Energy Commission, assistant secretary of state in the U.S. Bureau of Oceans, a zoology professor, and a winner of the United Nations Peace Prize. She's also the author of *Environmental Overkill*, which debunks the crapola Gore has been spreading about ecological disasters such as global warming, air pollution, endangered species, wetlands, overpopulation, etc. It's reviewed on p. 15 of my *Wisdom Guide*.

Yes, bless his heart, Rod even has me on his Birthday Book list.

Pigs is Pigs

When I went to Erasmus High in Brooklyn (NY), they had a booklet of recommended books to read. I naturally turned to the humor section, and listed there was *Pigs is Pigs*. It had to do with a Railway Express agent who received a freight collect shipment of two guinea pigs. The agent looked in the manual to see how much to charge, but could only find pigs listed, so he used that price. The customer looked at the bill and said hey, no way I'm going to pay that much for two little guinea pigs. The agent argued that, "Pigs is pigs." He sent word back to the home office asking for clarification.

Weeks went by with no response. The two guinea pigs turned into eight, then twenty. More weeks and a second generation was propagating, with the agent now dealing with hundreds of guinea pigs. Soon it was thousands.

I was reminded of this story when I read about scientists using pig organs for transplants. The problem is that the body's immune system immediately rejects the implant. That was only a small problem for doctors, who solved it by destroying the patient's immune system with very toxic drugs.

Their next approach, they decided, would be to take some bone marrow from you and inject it into a pig fetus before birth. Then, after they're born, some of their bone marrow cells could be removed and injected into you, making you like brother and sister, making the pig part human and you part pig. Theoretically it should work and genetic engineering will have done it again. Of course, it could have a side effect of giving you a strong desire to roll around in shit.

Hey, why bother to live a healthy life so you won't destroy your organs when genetic engineering will soon be solving the organ transplant problem? There are, by the way, 65,000 dying Americans who are desperately waiting for human organ transplants, but only a third of them will get one in time.

On the bright side, the Mayo Clinic, the best hospital in America, claims that 95% of their organ transplant patients live normal healthy lives for at least one year. What a fabulous success!

War and Peace

Why are we so warlike? I'll bet that you've never given it any serious thought. War is bad. Peace is good. Right?

Okay, now let's actually think about it.

I love walking around my north pasture every spring, with new wildflowers popping up almost every day. Every inch of the ground is contested. Vigorously contested. It's warfare at the plant level.

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that the cash-strapped Russians will fly more high-roller space tourists later this year. This could include *Titanic* producer James Cameron, who has already said that he wants to walk in space.

Thanks to Henry Feinberg K2SSQ, via Newsline, *Bill Pasternak WA6ITF, editor.*

New Element 4 Syllabus for Comment

The Question Pool Committee, National Conference of Volunteer Examiner Coordinators, has released the draft syllabus for the new Element 4 Question Pool. This question pool will become effective July 1, 2002. The draft syllabus is available for download at [http://www.arrl.org/arrlvec/pool.html]. The public is invited to comment on this syllabus. All responses must be received prior to August 15, 2001. Please direct your comments to: Scotty Neustadter W4WW, chair, QPC, E-mail [W4WW@arrl.net]; Bart Jahnke W9JJ, member, QPC, E-mail [vec@arrl.org]; and/or Fred Maia W5YI, member, QPC, E-mail [fmaia@prodigy.net].

Question Pool Syllabus:
Element 4 - Extra Class

Subelement E1 — Commission's Rules.
[7 Exam Questions —7 Groups]

E1A Operating standards: frequency privileges for Extra class amateurs: emission standards: message forwarding; frequency sharing between ITU regions; FCC modification of station license; 30-meter band sharing; stations aboard ships or aircraft; telemetry; telecommand of an amateur station; authorized telecommand transmissions; definitions of image, pulse and test.

E1B Station restrictions: restrictions on station locations; restricted operation; teacher as control operator; station antenna structures; definition and operation of remote control and automatic control; control link.

E1C Reciprocal operating: reciprocal operating authority; purpose of reciprocal agreement rules; alien control operator privileges; identification. (Note: This includes CEPT and IARP.)

E1D Radio Amateur Civil Emergency Service (RACES): definition; purpose; station registration; station license required; control operator requirements; control operator privileges; frequencies available; limitations on use of RACES frequencies; points of communication for RACES operation; permissible communications.

E1E Amateur Satellite Service: definition; purpose; station license required for space station; frequencies available; telecommand operation: definition; eligibility; telecommand station (definition); space telecommand station; special provisions; telemetry: definition; special provisions; space station: definition; eligibility; special provisions; authorized frequencies (space station); notification requirements; earth operation: definition; eligibility; authorized frequencies (earth station).

E1F Volunteer Examiner Coordinators (VECs): definition; VEC qualifications; VEC agreement; scheduling examinations; coordinating VEs; reimbursement for expenses; accrediting VEs; question pools; Volunteer Examiners (VEs): definition; requirements; accreditation; reimbursement for expenses; VE conduct; preparing an examination; examination elements; definition of code and written elements; preparation responsibility; examination requirements: examination credit: examination procedure; examination administration; temporary operating authority.

E1G Certification of external RF power amplifiers and external RF power amplifier kits; Line A; National Radio Quiet Zone; business communications; definition and operation of spread spectrum; auxiliary station operation.

Subelement E2 — Operating Procedures.
[5 Exam Questions — 5 Groups]

E2A Amateur Satellites: Orbital mechanics; frequencies available for satellite operation; satellite hardware; satellite operations.

E2B Television: fast scan television (FSTV) standards; slow scan television (SSTV) standards; facsimile (fax) communications.

E2C Contest and DX operating; spread-spectrum transmissions; automatic HF forwarding; selecting your operating frequency.

E2D Operating VHF/UHF digital modes: packet clusters; digital bulletin boards; Automatic Position Reporting System (APRS).

E2E Operating HF digital modes

Subelement E3 — Radio Wave Propagation.
[3 Exam Questions —3 Groups]

E3A Earth-Moon-Earth (EME or moonbounce) communications; meteor scatter.

E3B Transequatorial; long path; gray line

E3C Auroral propagation; selective fading; radio-path horizon; take-off angle over flat or sloping terrain; earth effects on propagation.

Subelement E4 — Amateur Radio Practices
[5 Exam Questions — 5 Groups]

E4A Test equipment: spectrum analyzers (interpreting spectrum analyzer displays; transmitter output spectrum); logic probes (indications of high and low states in digital circuits; indications of pulse conditions in digital circuits); PC-based testing procedures and performance limitations.

E4B Frequency measurement devices (i.e., frequency counter, oscilloscope, dip meter); meter performance limitations; oscilloscope performance limitations; frequency counter performance limitations.

E4C Receiver performance characteristics [i.e., phase noise, desensitization, capture effect, intercept point, noise floor, dynamic range (blocking and IMD), image rejection, MDS, signal-to-noise-ratio); intermodulation and cross-modulation interference.

E4D Noise suppression: vehicular system noise; electronic motor noise; static; line noise.

E4E Component mounting techniques [i.e., surface, dead bug (raised), circuit board]; direction finding: techniques and equipment; fox hunting.

Subelement E5 — Electrical Principles
[9 Exam Questions — 9 Groups]

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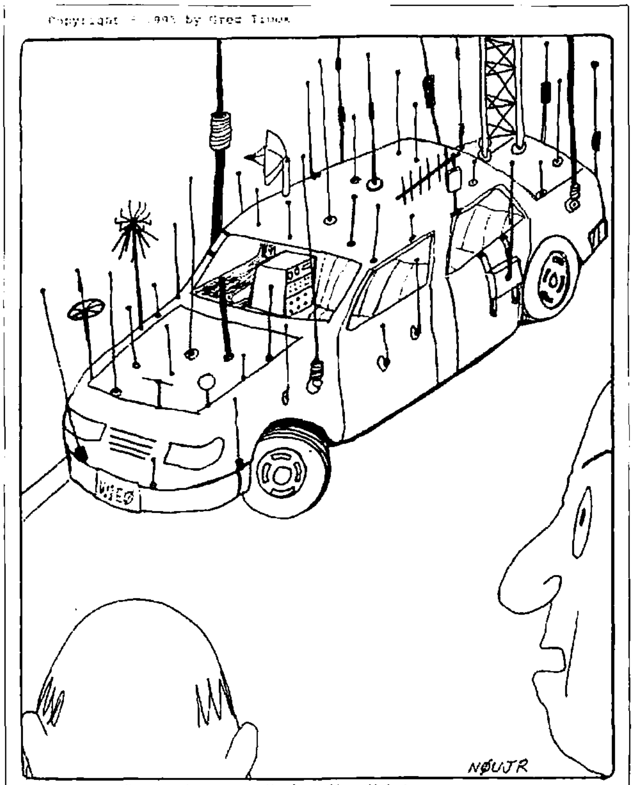

"...and since Jim's wife didn't want him setting up a station in the house..."

DAYTON DAYS

CLOCKWISE FROM RIGHT: *73*'s Evelyn Garrison with new Alinco distributor Craig Cota of Atoc; Les Sullins of D&L Antenna Supply; Linda from Am-Com; staff members of SGC; part of Yaesu's booths; staff members of Universal Radio; and Wayne Doocy and staff members of AEA.

NEVER SAY DIE

continued from page 4

In the forest surrounding the meadow, every inch of ground is the site of constant warfare. Vicious, to-the-death warfare. Only the strongest and most adaptable survive.

When I scuba dive the reefs around the world, I enjoy the beauty of the coral. Yet, if you've watched the PBS shows about the oceans you know that every inch of territory in the ocean capable of supporting life is a battleground — mostly with chemical warfare.

Then there's the food chains, both under water and on land, including ours. More vicious warfare, as the meat-eaters kill the vegetarians and eat them. The songs birds sing are war songs, warning other birds that this is their territory and don't mess with it. Birds eat bugs. Bugs eat bugs. Even ants have wars. Mess with a bee hive and see what happens. That ain't love and peace.

Male animals and birds battle for mates. So do fish. So do men.

Everything live is fighting for life, territory, and reproduction.

Peace? Not if you want to survive.

Submarines

How key were submarines in WWII? Well, with just two percent of all the Navy's personnel, our submarines accounted for more than half of all Japanese shipping destroyed during World War II. Two hundred forty-nine U.S. submarines made Pacific war patrols. Of those, 52 were lost, with a casualty rate of six times that of non-submariners — the highest loss of any branch of the military. Our subs sank 1,392 Japanese vessels.

What was it like on a sub during the war? Read my $5 book, *Submarines in WWII*, for the story of 90% boredom and 10% excitement none of us will ever forget. What's it like to be depth-charged? What's it like when your new-model electric torpedoes are faulty and you almost get sunk as a result? What's it sound like when a ship you've torpedoed is sinking?

JFK and the ETs

Still another who-shot-JFK story arrived via E-mail. I enjoy conspiracy theories, but I don't buy into them without a lot of reliable information to support 'em.

This one has Kennedy, shortly before he was shot, handing Texas governor John Connally the notes for a speech he was going to make. Connally was seriously wounded. Once he read the notes he was terrified for his own life, so he put the notes in a safety deposit box, not to be opened until after his death. He died in 1993 and his aide took them from the box and kept them.

Enter Professor Lawrence Merrick of Cambridge, MA, who got the notes from the aide. The result is a book due out soon, *Killing the Messenger: The Death of JFK*.

His speech was announcing government contact with aliens, saying that they are friendly, not to be concerned, and that details would be released soon. His shooting had to do with keeping this information from the public.

Truth or hoax?

On the other hand, I've also read that JFK had just proposed that the U.S. issue its own currency instead of borrowing it from the Fed and paying interest on it. Since this would cost a very small group of international bankers trillions of dollars, that story also made sense as a reason for JFK's shooting.

There could have been quite a crowd of shooters on that grassy knoll.

Vitamins and Alzheimer's

Just as I've predicted, a Swedish study reported in the *Journal of Neurology* says that nutrition can help prevent Alzheimer's. I haven't seen any reports of studies to see if nutrition can actually reverse Alzheimer's, but I'll be surprised if it can't. The study found that vitamins could prevent Alzheimer's dementia.

I suspect that the reason vitamins and good nutrition make the difference is that they keep the immune system strong enough to keep the brain from turning to mush.

No, Coke does not qualify as good nutrition. Nor do Big Macs. Nor fries.

In another report it was pointed out that 88% of all medications use aluminum hydroxide as a stomach buffer. This, and antacids, are major sources of aluminum.

As I've mentioned before, we also get aluminum from vaccinations and anti-perspirants.

So what's the big deal about aluminum? Excess aluminum in the blood gathers in the brain, interfering with the microvolt brain wiring, slowing down and eventually stopping the circuits from working. Pffft goes short-term memory, and then longer and longer.

My mother, who died of Alzheimer's, could remember her address when she was seven years old in Denver, but couldn't recognize the people she was living with at the nursing home.

I believe that Alzheimer's can be reversed with diet. Please, someone with a sick relative, try out what I recommend in my health guide and let me know how you do.

Women Smokers

As bad as smoking is for men, it's far worse for women, according to a report from the National Institutes for Health. Women are up to twice as likely to suffer strokes, lung cancer, and heart attacks as men smokers. It also can cause birth defects, lower IQ, and low birth weight for their babies. Then there's severe PMS and early menopause. The bottom line is that any young girl these days who takes up cigarettes is either pathetically ignorant, or flat-out stupid. Or both.

Famous Hams

Three hams have recently made the news big time — though their being hams hasn't been mentioned in all the media attention, far's I know.

Number one on our 2001 hall of fame ham list is Dennis Tito KG6FZX who, despite every effort of NASA to prevent it, made a $20 million tourist trip to International Space Station "Alpha." Dennis, who had been a rocket engineer for NASA's Jet Propulsion Lab, wised up and left NASA to start an investment company. Did well, of course.

Number two was Veronica (Roni) Bowers KD4CKM, the Baptist missionary who was shot down by a Peruvian Air Force plane. The story is that the Bowers Cessna float plane was spotted by a CIA surveillance plane, which reported it to the Peruvian military, requesting them not to fire on the Cessna since it did not seem to be carrying drugs.

The third ham in the news is Robert Hanssen K9QVL, the accused spy. Ooops.

More Famous Hams

How many famous hams have you worked? How many do you, or have you known personally. How many have you visited in their homes?

I remember one time I almost worked Arthur Godfrey. He was on a DXpedition to French West Africa at the time and I really wanted to contact him, but I didn't have enough signal to cut it. It wasn't that I was anxious to rack up a new country, or even to have the bragging rights for contacting Godfrey, which probably would have made my Been-There, Done-That list. What was driving me was that with him on the expedition was Colonel Carol Cone, who was a good personal friend from back in 1933.

Col. Cone was a fellow student with my father in 1920 at Kelly Field (San Antonio), and often visited us for dinner when we were living in Washington DC. He and I would play games while my folks cooked dinner. So I was mighty disappointed when I

Continued on page 61

Phil Whitchurch G3SWH
21 Dickensons Grove
Congresbury, Bristol
BS49 5HQ United Kingdom

The Antenna That Never Was

... and the 4S7WHG DXpedition that ALMOST followed suit.

It all started to go wrong when Jan and I arrived at Sri Lanka's Bandaranaike International Airport, about 30 km north of the capital, Colombo, at about 5 a.m. on 9th November last year. Having cleared immigration, we were horrified to discover that the airline had lost two of our three bags — one containing the R-7000 vertical, and the other my clothes, tools, Vibroplex key, MFJ-269, and headphones. Jan's bag arrived safely!

Having spent what seemed like ages filling out a lost baggage report for the airline, we stumbled through the "Green" channel and met up with our English-speaking driver/guide, Karu.

We explained our predicament, and Karu immediately took us to our travel agent's desk in the arrivals area, where I signed a number of forms and handed over my passport and the keys to our missing bags so that the agent could deal with the Customs formalities when the bags did arrive. In anticipation of having the R-7000 with me, which I carry in a six-foot-long ski bag, I had asked for a car with a roof rack. Such things are unknown in Sri Lanka, and we were provided with a six-seater mini-bus, which was a lot more comfortable than a car, particularly on the long journeys over very poor roads.

Photo A. G3SWH operating at Milton's Hotel, Unawatuna.

We then set off on a 3-hour drive to the Kandalama Hotel, near Dambulla, arriving in time for lunch. With a six-hour time shift, a 13-hour flight, and no sleep on the plane, this was now about 7 a.m. body-clock time and we were exhausted.

I had first made contact with Dammika Fernando 4S7DF, the president of the Radio Society of Sri Lanka (RSSL) in October 1999, via the RSSL Web site [www.qsl.net/rssl/], which contains a section on how foreign amateurs can obtain a license to operate from Sri Lanka. Dammika responded very promptly, indicating that he was willing to help with the license application process, which involved submitting copies of numerous documents, including my UK license, a document from the British police stating that I do not have a criminal record, and a copy of the Icom IC-706 technical specifications.

This was all sent off by snail-mail on 11th February 2000, and on 6th July I received an E-mail from Dammika saying that their Ministry of Defense had approved the license application. It was then necessary to snail-mail the document back to the UK for me to sign and return to Dammika, together

with the modest fee of 650 rupees (about £6.50), upon receipt of which the Sri Lankan Telecom authorities would allocate the callsign. On 25th September, I received another E-mail from Dammika telling me that I had been allocated 4S7WHG. I had asked for 4S7WH, amongst others, but they always add a "G" for "guest" operators. I asked for him to send it to me by snail-mail, or even a copy by E-mail, but he was strangely reluctant to do so, preferring to meet me on arrival and hand it to me then. This was not practical, given the ungodly hour at which we arrived, so we arranged for Karu to collect it the night before.

Clause (9) of the license states, "The licensed station shall only be operated at the address shown in the license." Dammika had inserted his own address for convenience as, at the time of application, I had no idea where we would be staying. As I was planning to be active from a variety of different locations around the country, he later advised me to append "/A" to my call and to inform the Sri Lankan Telecom authorities by fax of my itinerary, which I did. Unfortunately, I never received any form of acknowledgment or confirmation from them.

We actually booked our trip through Jetwing Travels in Colombo, and Dammika told me of an amateur who worked there. This turned out to be Romesh 4S7RF, who is also GØTAO and the chief executive of Jetwing Hotels. In an exchange of E-mails in mid-October, Romesh mentioned the theoretical need to obtain an "equipment release letter" from the Sri Lankan Telecom authorities to present to Customs on arrival. He told me that this process can take 2–3 months and that most visiting amateurs take their chances with the "Green" channel. He added that there had never been a problem to his knowledge.

As there were only a few weeks before we left UK, obtaining an equipment release letter was not practical. I made various inquiries of the Bristol Chamber of Commerce, the Sri Lankan desk at the DTI, and the UK Customs at Bristol Airport. No one was able to give me any sort of sensible advice as to the best way of documenting such equipment as I would be carrying, so I was left with preparing a list with an official-looking UK Customs stamp on it and following Romesh's advice and taking my chances with the Sri Lankan Customs.

Anyone participating in Sri Lankan traffic seemingly does so with some contempt for life. Basically, the Singalese philosophy on traffic boils down to the idea that every two-lane

Continued on page 12

Photo B. The setup at Milton's Hotel.

The Antenna That Never Was

continued from page 11

road is wide enough for three cars, buses, or trucks — all at the same time. This naturally leaves enough space for two bicycles and cows on the loose, not to mention pedestrians. At times, traveling on the island requires some extraordinary driving skills but, in the end, there is always some maneuver you can make to avoid the bus or truck that is coming straight at you, making you realize that you may have just avoided reaching a premature end to your holiday. During the first few days of our stay, driving on these roads caused us to miss an occasional heartbeat, but after that we (more or less) came to accept the situation as part of the experience.

On arrival at the Kandalama, I had literally only the clothes in which I stood up, plus two pairs of underpants, which Jan had carried in her bag. Fortunately, essentials like toothpaste, razor, etc., were also in her bag. A visit to the hotel shop provided two tee-shirts, but nothing like socks or shorts. The hotel is literally in the middle of nowhere, so there was no chance of buying any other emergency clothes. After a wonderful Ayurvedic head massage and an excellent dinner, I washed my socks and we went to bed feeling somewhat numb.

Next morning, we went off to the spectacular rock fortress of Sirigiya. Built in the 5th century on top of a 200-meter-high rock, it's compared by guidebooks to something like a European chateau plonked on top of Ayers Rock. We decided not to climb the precarious staircase to the top and went on to the ancient capital of Polonnaruwa. The ruins here date from the 11th century and include some remarkable Buddhist temples and rock carvings. It started to rain whilst we were there and, due to the necessity to remove one's shoes when visiting Buddhist temples, much of the visit was conducted with wet feet.

On the way back to Kandalama, my mind started to work, and I began to think of what could be achieved radio-wise with the equipment I had on hand. I carry the Icom IC-706, power supply, laptop, wire antennas, coax, and various odds and ends in my hand luggage, so I had the basis of a station. Keying the transmitter was possible using the laptop's keyboard and CT, but I was missing a pair of headphones. Jan came to the rescue with a pair of simple ear pieces from her portable CD player. I was in business!

The Kandalama hotel is an architectural gem, built into the side of a mountain, facing north, and overlooking a 1st century manmade lake called a tank. The exterior of the 1-km-long building is covered in carefully cultivated vegetation to hide the concrete outline. Our room was on the third floor, with a convenient tree in the garden below, so a sloping dipole was practical and the takeoff looked good. I already had permission from the hotel manager to operate, so I set about rigging the antenna. This proved much more difficult than expected, mainly due to the nylon string tangling in the vegetation, and I had to abandon my efforts when dusk fell.

We left next morning for a three-night stay in Kandy, the ancient capital of the country, so I was hopeful of some activity from the Citadel Hotel. When we arrived, there was a message

Photo C. Left to right. Phil G3SWH and Romesh 4S7RF.

from the airport saying that they had received my bags, which had been left in Amsterdam, but that the Customs would not release the antenna or other items without a copy of my license, so could I please fax them a copy. The good news was that the bag containing my clothes was en route from Colombo. The hotel's fax machine failed to co-operate, but I was fortunate to be able to send the copy document back with the driver who delivered my clothes.

Again, I had permission to operate from the hotel management and made contact with the chief engineer almost as soon as we arrived. He could not have been more helpful, even arranging one of his electricians to scramble over the hotel roof to help rig the antenna — much to the alarm of some of the other guests!

There was no opportunity to operate that day, as we went off to see the Temple of the Tooth and a typical Sri Lankan cultural show. Later that evening, the hotel laid on some live music, which was very loud in our room, resulting in a late night change to a quieter room on the ground floor. The antenna thus had to be taken down again very early the next morning before we set off for the day's visit to the Pinewella Elephant Orphanage at Kegalle. The highlight of the morning was to see about 50 elephants of all sizes being driven down the village street to bathe in the shallow river.

The antenna I rigged at the Citadel was a simple wire dipole for 20, 30, or 40 meters, adjusted by means of crocodile clips and supported by a length of nylon string. I have successfully used this particular antenna in Tanzania and on Reunion, and lastly on the Wasini Island expedition in Kenya. I was rather taken aback to see that the 20 meter section had been folded back on itself, presumably to resonate on 17 meters during the visit to Wasini Island. The new room was not so well situated for a horizontal antenna, but a sloping dipole from a tree was possible. The assumed 17-meter dipole didn't resonate on 17 meters, or on any other amateur band, but I did manage to tune it by means of an ATU. After a few unanswered CQ calls on 18073 kHz, I moved up the band and found Kjell SMØCCE just finishing a QSO with another 4S7 station. I called him and he came straight back and gave me 549 — my first QSO at 11:08 UTC on 13th November! After a short chat, Kjell kindly left me with the frequency. I had about 40 QSOs, mainly with eastern Europe, but including G3JZI over the next hour or so, but I was obviously not getting out as well as I would have liked.

We then moved on to Nuwara Eliya in the hill country for one night. Even though I had permission to operate at the Galway Forest Lodge, overhead power lines surround the building and we were scheduled to leave at dawn the following morning, so amateur radio was not on the agenda for that day. There was a fax from Jetwing to say that the Customs would not release the antenna to them as they required some more documentation. I spoke to Dammika 4S7DF by telephone, who told me not to worry, as a friend of his was the chief Customs Officer at the airport and he would try to arrange the release of the equipment on my behalf. I asked him to arrange to forward it to our last hotel at Unawatuna, where we were to spend five nights relaxing after a fairly grueling tour.

We then moved on for two nights at the Yala Safari Beach Hotel, close to the entrance to the Yala West National Park on the southeastern coast. What a superb hotel! We arrived in the late afternoon after a long journey via Horton Plains, where we made a 10 km trek to see World's End, an awesome 700-meter precipice with magnificent views. Our room faced onto the beach and was about 150 meters from the sea itself. There were two lines of stunted trees, between which I rigged a horizontal dipole running east/west. By this time, I had calculated the length of a 20-meter dipole, and adjusted the so-called 17-meter dipole to this band. Without an ATU, the SWR was 1.3:1; the first QSO was with R1ANZ at 12:40 UTC, just about dusk, on 15th November. The choice of 20 meters proved to be a bad one, as activity was almost nonexistent at the times when I

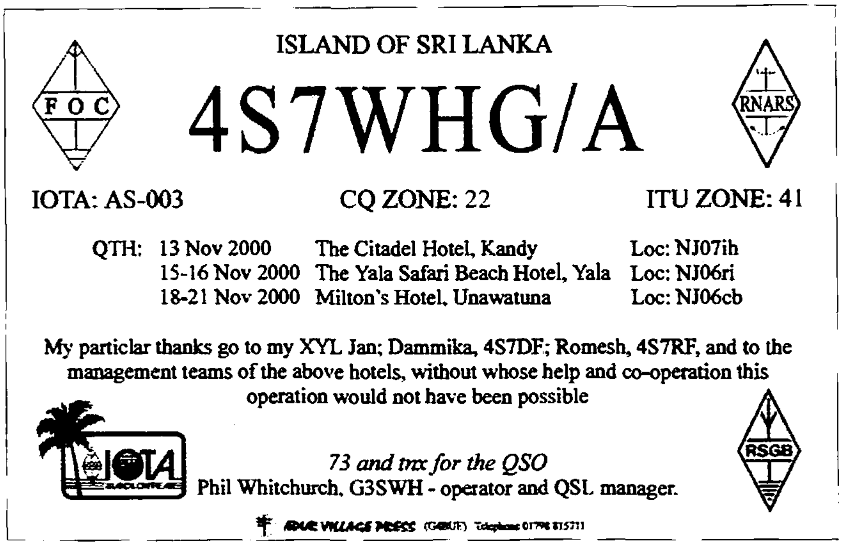

Photo D. *The QSL card.*

was active. A short session before dawn (about 23:00 UTC) the next day produced QSOs with several Caribbean stations, Canada, and the eastern seaboard of the USA, but only 15 QSOs in total.

One of our principal interests on our travels is birdwatching, and we were well rewarded in the Yala area with painted storks, blue swamp hens, and three species of bee-eaters, as well as elephant, buffalo, and wild boar. The hotel does not have a swimming pool, which was probably just as well, as there were several crocodiles in the adjacent lagoon who would probably have taken up residence. The morning we left, it was raining and I was up before dawn, running around the beach in swimming trunks with a torch between my teeth, taking down the antenna.

We were looking forward to spending a few days relaxing at the Unawatuna Beach Hotel, near Galle on the southwestern coast. This hotel was our choice, rather than a recommendation from Jetwing, and it very quickly proved to have been a mistake. Our room was on the third floor overlooking the garden and was really quite comfortable, except that it stank of paint. We had expected a much larger property, with some space for antennas. As it turned out, it was extremely overcrowded and noisy. The last straw was a disco during the first evening, the noise from which was inescapable. Jan was in hysterics by 10 p.m. When I complained, the duty manager cheerfully told me it would be over by 12:30 a.m.! There were no alternative, quieter rooms available, and we moved out the following morning.

With Jetwing's agreement and the help of a local tuk-tuk (three-wheeled taxi) driver, we found and moved into a smaller hotel called Milton's, about 0.5 km away, which was much more suited to us. Telephone calls to Jetwing revealed that the Customs would still not release the antenna, and they recommended I go to Colombo to try to sort it out myself. I reluctantly agreed to travel earlier than planned on our last day, with a view to negotiating its release so as to be able to take it home with me on the outgoing aircraft.

With the hotel owner's permission, I set up a sloping dipole for 12 meters in a tree on the edge of the Indian Ocean. This was facing southwest, which was not the best direction for Europe, but I managed to generate a respectable pileup between mid-afternoon and dusk on Saturday, 18th November. My signal was obviously not very strong, and G3HTA gave me 229. He was a comfortable 579 himself. When the band died, I'd made 214 QSOs. I was hoping for a repeat performance on Sunday 19th, but there was a tremendous electrical storm that afternoon which not only made operating slightly dangerous, but also was accompanied by torrential rain that reduced visibility to about 50 meters for several hours. The centerpiece of the dipole filled up with water and had to be dried out the next day when the rain had stopped.

Sessions on the afternoons of the 20th and 21st produced 174 and 134 QSOs respectively. I tried extending the dipole to work on 15 meters and 17 meters, but was obviously not getting out so well as on 12 meters when the band was open. Fluctuations in the electricity supply voltage sometimes meant that there was not enough voltage to operate the interface between the computer and the radio, which was most frustrating and led to reports of QSD.

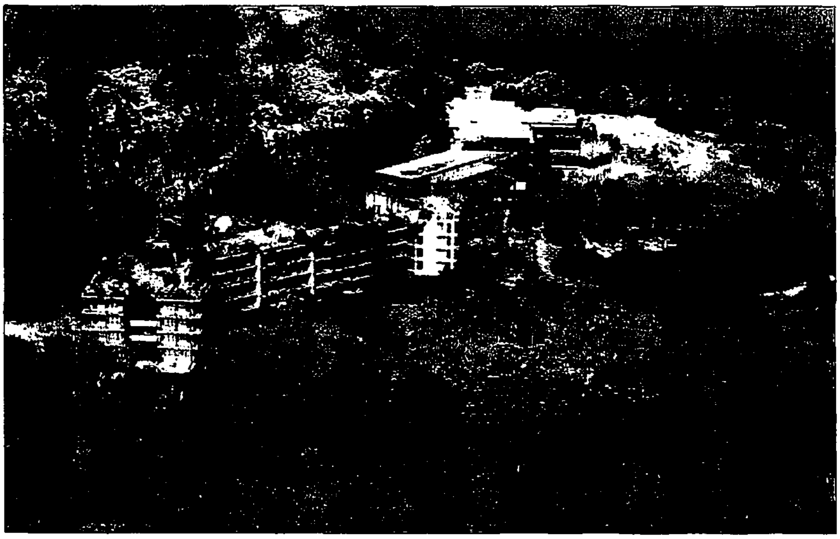

Photo E. *The Kandulama Hotel, near Dambulla.*

We traveled back to Colombo on the morning of 22nd November and were taken to the airport to meet the Customs officials. Bandaranaike Airport is subject to very strict security precautions. One guidebook says it's probably one of the most secure airports in the world. It's certainly bristling with armed troops and machine gun nests! After much delicate negotiation, I was able to persuade the Customs to allow me to collect the antenna, etc., on production of my boarding card. They took some convincing that I needed to check the antenna as hold baggage, i.e., before I was given my boarding card, but eventually agreed for me to call back at 2 a.m. the next day. When I was checking in the rest of our bags, they would release the equipment. Under no circumstances would they even consider releasing the goods to me that afternoon! So much for Romesh's claim of there never having been a problem with the Customs! However, I remain convinced there would have been no problem at all if the airline hadn't lost the bags.

At 2 a.m. I duly reported to the Customs officer in the departures hall. Check-in desks at Bandaranaike International Airport open promptly three hours before departure time, so we had to hang around for another 45 minutes before we could even think about checking in. Once through the security check, I was whisked off to the arrivals area and produced my authority to collect the equipment. After much further deliberation and form filling, I was allowed into the store to identify the bags. The ski bag was immediately obvious, but the two boxes containing the MFJ, Vibroplex, etc., had been put into a large plastic bag and both secured with wire seals. There was a further difficulty when I tried to take both parcels, as the Customs paperwork only related to one parcel! After much further negotiation and the payment of a 500 rupee "storage charge" (about £5), I managed to extricate myself and the two bags to the departures area and check them in.

The flight home left at 06:45 local time and called at Male in the Maldives and Abu Dhabi in the UAE before arriving at Amsterdam at 17:20 local the same day. There was a short delay before our flight to Bristol, which arrived at 20:25 local. To crown it all, our very carefully arranged lift home got the day wrong and we had to take a taxi from the airport. Once we got home, we had been traveling for 26 hours, and were again exhausted and in need of a holiday to recover. We were waking up at 4 a.m. every day for the following week!

I made a total of 584 CW QSOs with 63 DXCC entities, 507 of which were on 12 meters, which was nowhere near the level of activity that I had planned. Once again, I have proven to myself (if to no one else) the need to have a simple but flexible antenna system where band changes can be easily made to suit the prevailing propagation.

Chris Page G4BUE at the Adur Village Press pulled out all the stops and both printed and despatched the QSL cards within 24 hours of receiving the fax of my very rough design. The first direct cards were sent out within a week of returning home. QSLs are available from either my *Callbook* address with return postage and SAE or via the RSGB bureau.

My particular thanks go to my XYL Jan; Dammika 4S7DF; and Romesh 4S7RF/GØTAO; and to the management teams of the Citadel Hotel (Kandy), the Yala Safari Beach Hotel (Yala), and Milton's Hotel (Unawatuna), without whose help and cooperation this operation would not have been possible.

Photo F. Phil with a new friend, at the Pinewella elephant orphanage.

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Power Supplies Explained

The esoteric facts.

In some places, power supplies are called power conditioners, and power supplies are reserved for the AC mains, generators, or batteries. I'll call those things that change the AC mains to DC, power supplies.

The process of converting AC voltage to DC requires rectifiers to change the AC to pulsating DC which must then be filtered or smoothed to a more or less constant value. The filtering can be complex or as simple as just a capacitor. The current to be provided usually dictates the kind of filtering that is used. The voltage may have subsequent regulation depending on the needs of the circuits to be powered.

Rectification is usually accomplished with silicon diodes. Aside from their small size and long life expectancy, semiconductors are preferred because of their low forward voltage drops. Low forward voltage drops leads to increased efficiency and lower transformer volt amp ratings. In the '50s, selenium stacks were used for rectification, and before that vacuum tubes, either diodes or mercury vapor, were used. Silicon rectifiers have voltage drops in the order of a volt or less, compared to the fifty volts or so with tubes. It's easy to see why tube rectifiers are seen only in old equipment. If you modify some old gear by swapping tubes for semiconductors, be sure to allow for the increased output voltage that will occur with semiconductors. Of course, you can add resistance in series with the diodes to provide the extra voltage drop that existed in the tubes.

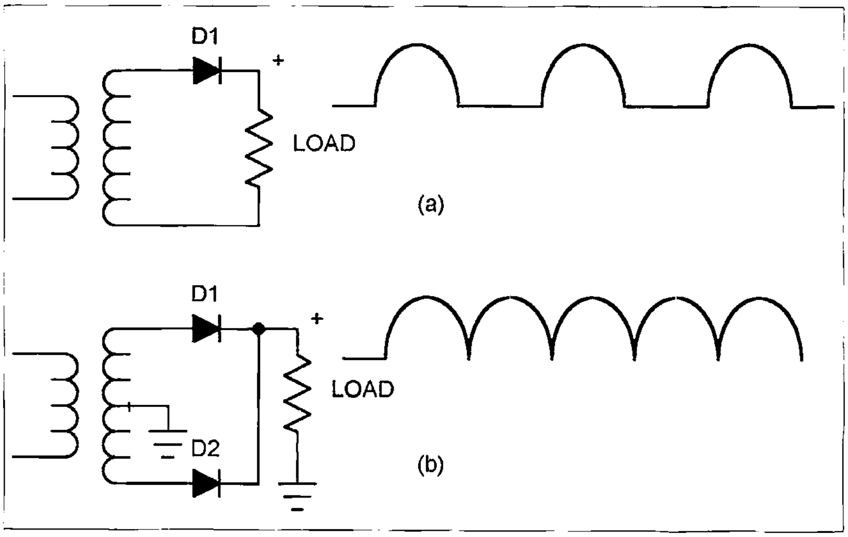

Fig. 1. (a) A low current supply can be half-wave. (b) A single-phase center-tapped rectifier uses the transformer more effectively.

A transformer is usually used to change the input AC to the level needed. The transformer is rated in terms of volt amps (VAs) instead of watts. The physical size of the transformer is directly related to VAs: small VA, small size. There is some latitude in the relationship, but a small transformer delivering high VAs will operate with a high temperature and have poor regulation. That is, the secondary voltage will drop under load. For example, a transformer may be rated at 25 volts at 2 amps, but unloaded or lightly loaded, the transformer's output voltage may be 28 or 30 volts. You can live with that if you accept the fact that the output voltage will vary with load.

Some transformers that are wound on special cores like Hypersil, a Westinghouse trademark, can reduce the size a little bit, but they are more expensive. The transformer can be a tapewound toroid, but it will be even more expensive for a given VA. There are no real standard transformers, but voltages of 6.3 V, 10 V, 12.6 V, 18 V, 24 V, and 25.2 V are fairly common with a range of secondary currents.

Rectification of the output of the transformer comes in two forms: half-wave and full-wave. Half-wave rectifiers [see **Fig. 1(a)**] conduct only for a half-cycle and consequently produce DC current in the transformer secondary. The DC current can lead to saturation of the core, which results in reduced output voltage and heating in the primary. For light loads, the transformers probably have enough iron in the core so they won't saturate. Still, it's a poor use of the core's VA capability, and full-wave rectification is usually used.

Full-wave rectification, shown in **Fig. 1(b)**, conducts on both halves of the cycle: D1 conducts on one half of the cycle and D2 conducts on the other half. The DC current in each half of the centertapped secondary produces opposing magnetization and doesn't saturate the core. Full-wave rectification can be accomplished with two diodes and a transformer with a center-tapped secondary or with a single secondary transformer with four diodes in a full-wave bridge as shown in **Fig. 2(a)**. Since two diodes of the bridge are in series, the bridge has a higher forward voltage drop. An untapped secondary also means the transformer can be marginally smaller and cheaper for a given VA because a single secondary is smaller and cheaper to wind than two.

The bridge arrangement is commonly used for higher currents or when only a transformer with an untapped secondary is available.

A three-phase transformer is almost always used with a bridge rectifier as shown in **Fig. 2(b)**. Three-phase transformers are usually wound with a delta connected primary to ensure balance on the lines. The secondary can be connected either as a wye or delta. The phase relationship of the wye and delta are 60°. The secondaries of the wye have a common terminal, the neutral. If the line-to-line voltage of the delta is 208 V, the line-to-neutral voltage of the wye is 120 V. Unfortunately, three-phase power is not commonly available to residential customers and we have to settle for single-phase power. 220 volts single phase is usually available and a 20 A branch can easily supply the power for a kilowatt station.

The semiconductors have a forward voltage drop given as V_f for some specified current. The forward drop of the rectifiers subtracts from the voltage of the transformer. This effect on the output is small, effectively reducing the transformer's secondary voltage by a volt or so. This difference is usually ignored unless the secondary voltage is very low and you're working with a tight voltage budget. When the forward voltage drop of silicon rectifiers is too great, a change to Schottky diodes may be in order because they have a forward drop that is about half that of a silicon rectifier such as the 1N4001.

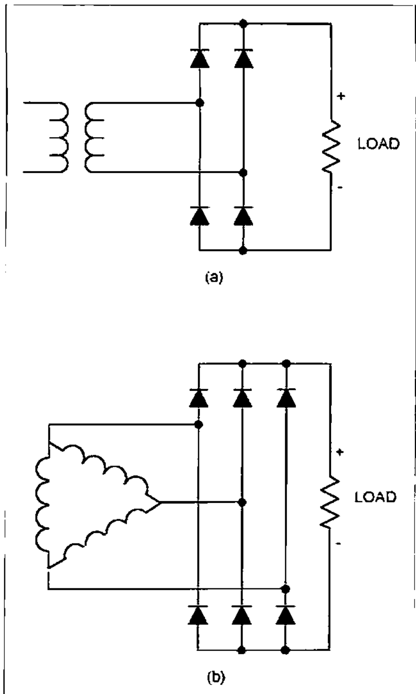

Fig. 2. (a) A full-wave bridge uses a single secondary. (b) A three-phase system uses a bridge.

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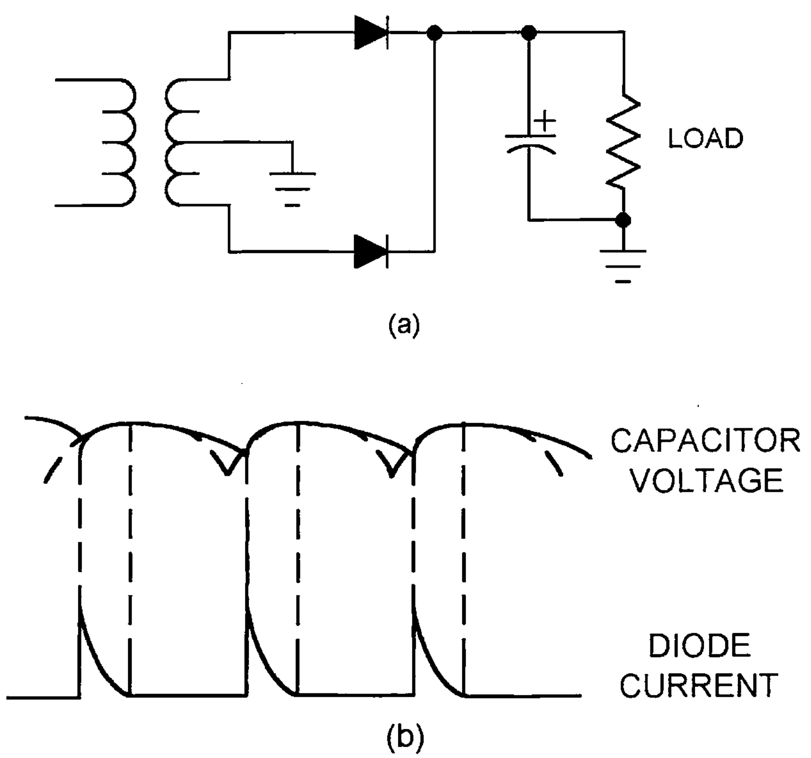

Fig. 3. (a) A full-wave rectifier can have a capacitor filter. (b) The rectifier current flows in short pulses.

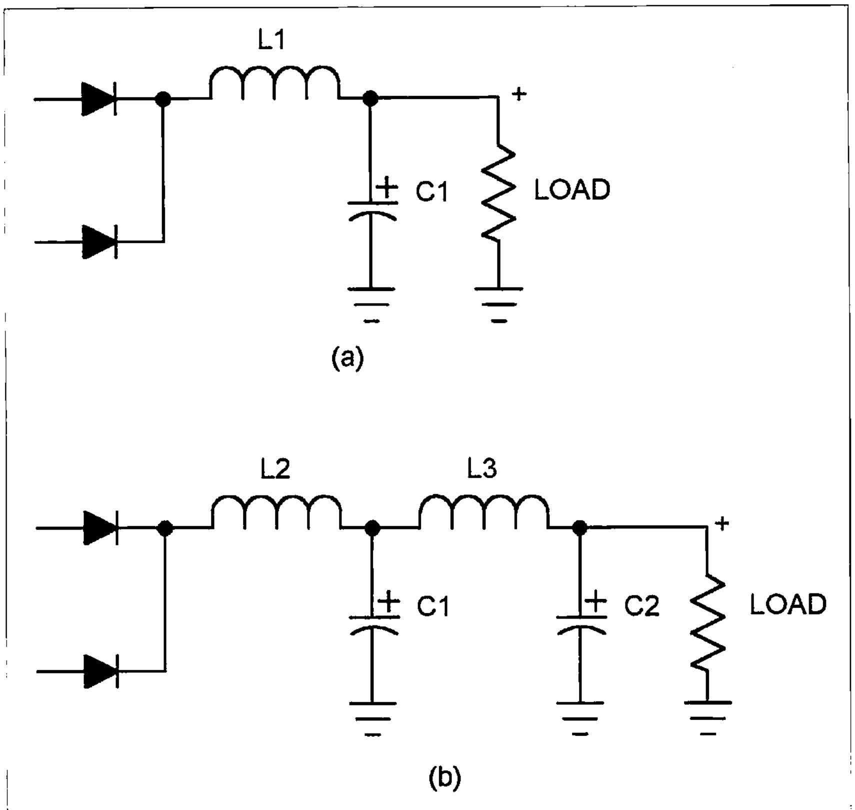

Fig. 4. (a) A choke input filter is used with higher currents. (b) A multisection filter further reduces ripple.

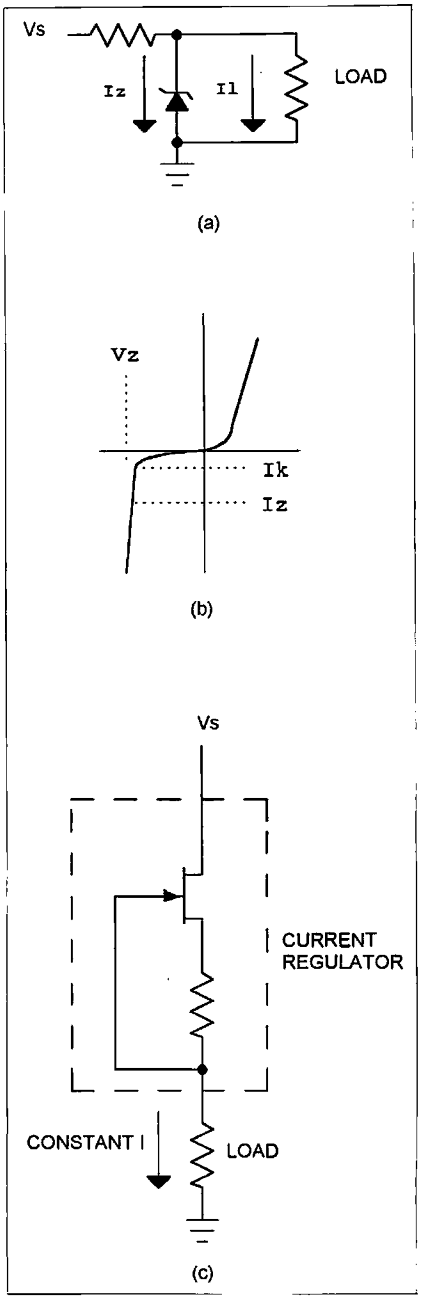

Fig. 5. (a) A zener diode is a shunt voltage regulator. (b) Zener diode's forward conduction is similar to an ordinary silicon diode's. (c) A field effect transistor can be used as a current regulator.

For example, the rectified voltage from a 12 V transformer is about 16 Vpk even though the transformer's peak voltage is 17. With a full-wave bridge rectifier, shown in **Fig. 2(a),** there are two diodes in series and the output will be about 15 volts.

The unfiltered ripple voltage at the output of a full-wave rectifier, the RMS of the ripple voltage to the DC voltage (the average voltage), will be 48%, but that is not a necessarily useful figure. In many applications the peak-to-peak ripple after filtering is the important value.

The RMS ripple for a three-phase bridge is 4.2% of the DC voltage, and the ripple frequency is six times the line frequency, while the ripple frequency for a single-phase full-wave rectifier is twice the line frequency. The advantages of a three-phase power supply are apparent: high ripple frequency for easy filtering and high current. Unfortunately, three-phase power is not common for residential customers, so the discussion of three-phase power supplies is only mentioned in passing.

The filter for the pulsating DC from the rectifier can take several forms, the choice being determined by the current levels. For example, a low current supply will probably have a simple capacitor filter. The capacitive filter is shown in **Fig. 3(a)**. The waveforms and currents are shown in **Fig. 3(b)**. The rectifiers charge the capacitor to the peak of the pulsating DC, and the capacitor is discharged by the load current. For example, a full-wave rectifier will replenish the charge every half cycle or every 8.3 milliseconds for 60 Hz mains. The voltage on the capacitor can be expressed as $dV/dt = I/C$, where dV is the change in voltage; dt is the time of charge or discharge in seconds; I is the current in amperes; and C is the capacitance in Farads.

Rewriting the equation for 60 Hz mains, $dV = I \text{ x } 8.3^{-3}/C$.

When C is 1000 μF and I is 0.1 A, the peak-to-peak ripple will be 0.83 volts.

A capacitive filter takes current from the rectifiers for that time when the output of the rectifiers is greater than the voltage on the capacitor. When the ripple voltage is low, the conduction time is short and the ratio of peak-to-average rectifier currents is high. For low currents this can be tolerated, but when the currents are high, rather large diodes are needed and the transformer must tolerate the high peak/average ratio. The result is poor utilization of the transformer's VA capability.

The peak inverse voltage (PIV) rating of the diodes is influenced by the voltage on the filter's input capacitor. When the voltage on the capacitor is equal to the peak pulsating DC voltage, the PIV is equal to twice the secondary voltage. For example, if the voltage on the capacitor is, say, +15 volts on the positive half-cycle, the peak voltage on the negative half-cycle will be −15 volts and the inverse voltage across the diode will be 30 volts.

A choke input filter as shown in **Fig. 4** is usually used for high currents. The input choke prevents the capacitor from charging to the peak, and when the choke is greater than a critical value, the current flow is continuous. The critical inductance is $R_{load}/1000$ Henrys. With an inductor greater than the critical value, the peak-to-average current ratio is about one, and the current rating of the diodes and the transformer is about equal to the load current. Finding a choke with the critical inductance will be a piece of luck, but any choke with more than the critical value is fine. The ripple at the output of a choke input filter can be expressed as $E_{ripple} \approx E_{DC} \times 0.83/LC$, where E_{ripple} is the RMS ripple voltage and L is in Henrys and C is in Farads. The inductor is assumed to be greater than the critical value.

A multisection filter is often used when the ripple must be low. A two-section filter, common in tube type applications, is shown in **Fig. 4(b)**. The first section can employ a relatively small choke whose reactance varies with current, a swinging choke. A swinging choke uses less iron in the core and operates near saturation. At high current, the choke operates near saturation and the inductance is relatively low, but at low currents the operation is below saturation and the inductance increases. A second filter section can be used to reduce the ripple voltage. It reduces the ripple by approximately $1/[(2\pi 60)^2 L_2 C_2]$. In many applications, a regulator follows the filter to stabilize the voltage and further reduce the ripple. A typical regulator IC reduces the ripple by as much as 50 dB.

Regulators can be either series or

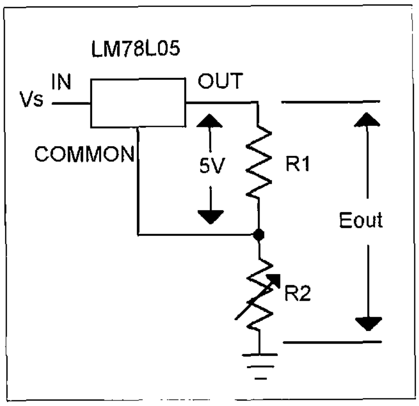

Fig. 6. A fixed three-terminal regulator can have a variable output voltage.

shunt. A zener diode shunt regulator as shown in **Fig. 5(a)** is equivalent to the VR tube of days gone by. The zener diode's characteristics are shown in **Fig. 5(b)**. When the voltage exceeds the zener knee, the diode breaks down and becomes a low resistance. The breakdown resistance is low and the voltage almost constant. The resistance in series with the diode limits the sum of the current in the load and the diode. As the load current decreases, the diode's current increases. The source voltage is $V_Z + Rx(I_Z + I_{load})$. For good regulation, the series resistance should be high compared to the breakdown resistance. At the knee, just at breakdown, the diode generates considerable noise and the breakdown resistance is rather high. Therefore, the diode current should be greater than the current at the knee. Zener voltages are available from 1.8 volts to 200 volts in approximately 10% steps, with power ratings from 0.25 watts to 50 watts.

Special-purpose field-effect current regulators are shown in **Fig. 5(c)**. Regulators for currents from 0.22 mA to 4.7 mA are available from Motorola. The regulators produce a constant current for supply voltages up to 100 volts.

While shunt regulators are simple, series regulators are very common for higher current. For example, the LM78LXX and LM79LXX are positive and negative three-terminal regulators in a TO-92 package. These regulators maintain a constant output voltage from 5V to 15 V for inputs of about 30 volts. The only requirement for the input voltage is that it be more than 2.5 volts above the regulated output voltage. These regulators can regulate about 250 mA when the case temperature is held to 25° C. But, that's an unlikely condition.

Thermal problems are probably the most bothersome ones to be faced in designing a power supply, or any high-power circuit for that matter, because the thermal constants of the semiconductors are not always given in the data sheets. While the maximum operating temperature is always given, the thermal resistance or derating factors are not. Fortunately, all packages of a similar type have similar thermal resistance. For example, the TO-92 small plastic package has a junction to case thermal resistance $R_{\theta JC}$ of about 83° C/W and a junction to ambient of something in the range of 200° C/W, the large TO-3 metal case typically has an $R_{\phi JC}$ of about 2° C/W, and the TO-220 has an $R_{\phi JC}$ of about 5° C/W. These resistances aren't exact, of course, but they are in the ballpark. The maximum junction temperature is usually 150° C or 200° C. In the absence of better information, these estimates can keep your transistors from becoming toast, at least until you can determine how hot they are.

From these estimates of thermal resistance and the rated power dissipation, you can calculate the maximum thermal resistance from the junction to the ambient (air), $R_{\phi JC}$ to $R_{\phi JA}$. For example, if the maximum operating temperature is 150° C and the power dissipated is 1 W, then $R_{\phi JC} + R_{\phi CS} + R_{\phi SA}$ must be less than 150° C/W. If $R_{\phi JC}$ is 83° C/W, and the thermal resistance case-to-sink $R_{\phi CS}$ is 1° C/W, then $R_{\phi SA}$ must be less than 65.7° C/W.

If the maximum operating temperature is 150° and the device is dissipating 1.5 W, there must be less than 150°/1.5 W (100° C/W) of thermal resistance between the junction and the ambient. With a TO-92 package with $R_{\phi JC}$ of 83° C/W then between the junction and the ambient, the heat sink must offer less $R_{\phi SA}$ than 17° C/W to keep the junction less than 150°.

The thermal resistance of the heat sink $R_{\phi SA}$ is strictly a function of heat sink size, and construction. Big heat sinks have lower $R_{\phi JA}$ than small ones, and copper is slightly lower than aluminum. Of course, cool air moving over any heat sink lowers the $R_{\phi JA}$ even more, and the more air, the lower the $R_{\phi JA}$. The cross-section of the sink at the transistor determines how quickly the heat is carried away. A large heat sink like the foil on a circuit board can be cool at the edges but hot at the transistor. A little more mass is required to keep the transistor from frying.

A smooth interface between the case and the heat sink is very important, as is the thickness of thermal grease smeared between the case and heat sink. More grease isn't better, either. The lowest case-to-sink resistance $R_{\phi CS}$

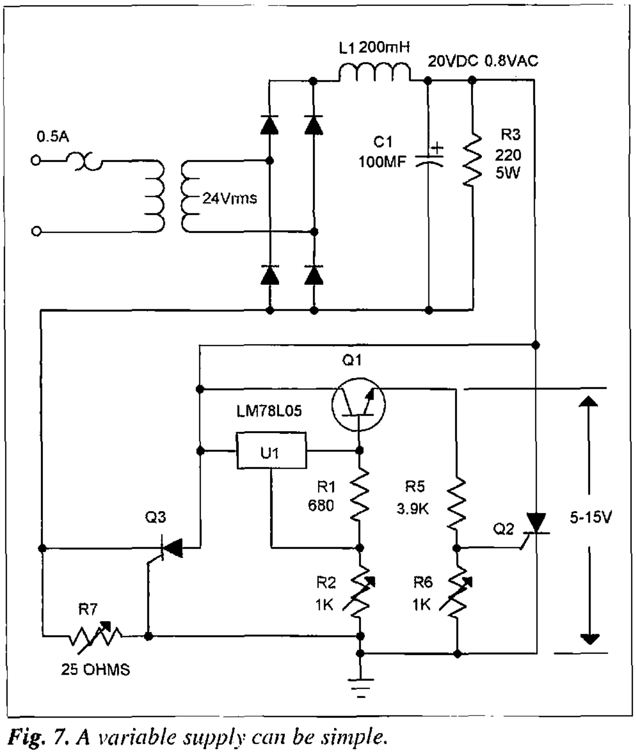

Fig. 7. A variable supply can be simple.

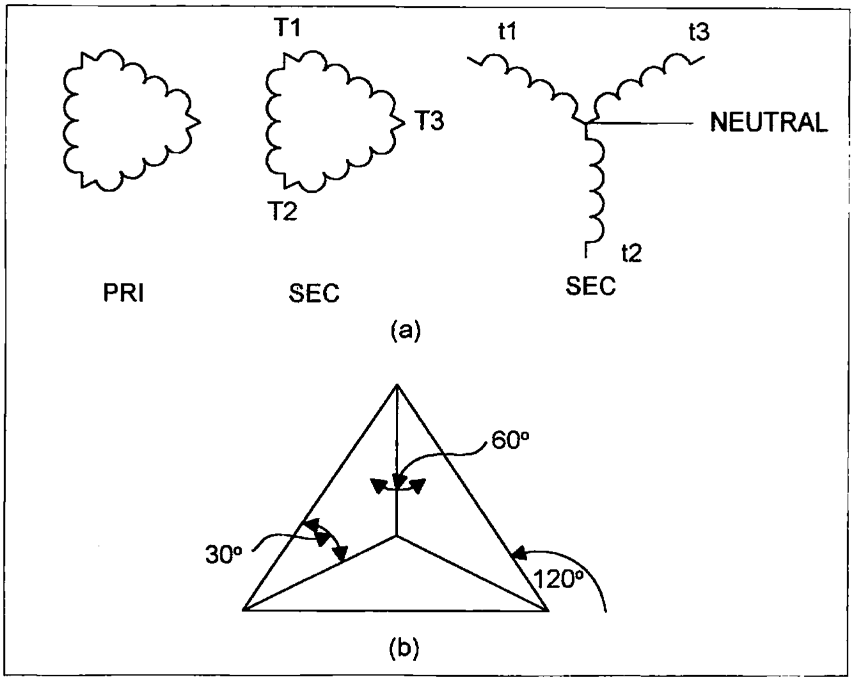

Fig. 8. (a) A three-phase transformer can have either wye or delta secondaries. (b) The wye and delta phases are 30° apart.

is obtained when the grease is barely visible.

The output voltage of a three-terminal 5- volt regulator like the LM78L05 can be increased by floating the common terminal on a constant voltage. **Fig. 6** shows how the output voltage can be varied. The voltage across R1 is a constant 5 volts; therefore, the current in R1 is also constant at 5/R1. This constant current flowing in the resistance R2 raises the common terminal of the 78L05 to 5 x R2/R1 volts. The current in R2 is the sum of the current in R1 and the quiescent current of the regulator. The quiescent current of the LM78LXX varies from about 5 mA to 4 mA as the case temperature approaches 50° C. Without R1 and only R2 in the common terminal, the voltage at the common terminal could be raised to the required value, but the regulated voltage would be temperature-sensitive. It's better to have a regulated current as a significant part of the total current in R2. The output of the regulator is then the sum of the voltages across R1 and R2.

A higher-current regulated supply can be made by applying the output of the LM78LXX to the base of a power transistor as shown in **Fig. 7**. The regulation won't be quite as good as with the LM78L05 because the emitter follower can't have unity gain, and the emitter won't exactly follow the base, but it's close.

A simple variable 5- to 15-volt supply capable of about 2 A is shown in **Fig.** 7. The transformer secondary voltage is 24 volts RMS. The input filter inductor

should be larger than the critical value at the lightest load. Therefore, a 200 Ω 5 W bleeder resistance on the filter is used to establish the minimum load. The critical inductance then is 200 mH.

The LC product of the filter must exceed a certain minimum to ensure a required ripple factor. The ripple factor for single-phase full-wave input is r = 0.83/LC, where L is in Henrys and C is in µF.

When L is 200 mH and C is 100 µF with 50 WVDC, r = 0.0415. When the unfiltered ripple is 48%, the resulting ripple is about 2% or 0.83 V.

The output of U1, the LM78L05, in **Fig. 7** cannot be greater than about 16 volts if U1 is to remain in regulation. The output of U1 can be made variable as described earlier (see **Fig. 6**). When R1 is about 680 Ω, the current in it will be about 7 mA and the current in R2 will be about 12 mA. When R2 is 1k, the output voltage will be about 17 V.

The h_{FE} of the 2N6594 Q1 is typically 90 when the collector current is 2 A and requires about 22 mA of base current to be supplied by U1. The current supplied by U1 is base current plus 7 mA for R1. When the output is 5 V and the input is 20 V, the power dissipation in U1 will be 15 V x 0.029 A, or 0.3 W. With the junction-to-case thermal resistance $R_{\phi JC}$ for a TO-92 package about 83° C/W, a small heat sink with a $R_{\phi SA}$ of about 122° C/W is required to keep the temperature below 125°.

The power dissipated in Q1 is also greatest when the output voltage is minimum. The maximum dissipation is about 30 W when the output is 5 V and the current is near 2 A. The 2N6594 transistor is rated at 100 W when the case temperature is at 25° C and has zero dissipation at 200° C. The thermal resistance junction-to-case, $R_{\theta JC}$, is 1.75° C/W (175°/100 W). When the junction temperature is 200° C and dissipation is 30 W, the thermal resistance junction-to-ambient must be less than 6.67° C/W (200° C/30 W). Since $R_{\theta JC}$ is 1.75° C/W, the thermal resistance from case to ambient must be less than 5° C/W. With 30 W of dissipation, the heat sink will be about 122° F. That won't raise a blister, but it's uncomfortably hot.

Using an LM79L05 and a 2N6594 will make a variable negative supply from a –20 volt unregulated supply.

For those who need high power and have three-phase power available, a delta delta wye transformer with the primary and one secondary connected delta and the other secondary connected wye provides the opportunity to have a very low ripple supply with minimal filtering. The line-to-neutral are displaced 30° from the line-to-line voltages. **Fig. 8** shows the phase diagram of wye and delta. Taking the delta connection as the reference of one, the line-to-neutral of the wye has a value of 0.57735. A 208 V delta produces 120 V when connected as a wye. Since the delta and wye have a 30° relationship, full-wave rectification produces a ripple frequency that is 12 times the line frequency, with a ripple of about 2%.

The matter of protection of the supply and load should not be ignored. A fuse or circuit breaker in the primary of the power transformer may protect against overcurrent, but even a fast-acting fuse may not be fast enough to protect transistors that are in the load. Fuses and circuit breakers certainly aren't variable. However, a solution is at hand.

A small SCR like the 2N5060 can provide variable overcurrent protection. Q3 in **Fig. 7** triggers when the voltage at the gate exceeds 0.6 V and effectively shorts the output of the filter. The main circuit breaker opens after a fraction of a second. The current in the SCR will be high until the breaker opens, but the effect is a transient that the SCR can tolerate. Of course, a fast-acting breaker is desired that opens with 0.5 A. A large safety factor in the current rating is not required, because the in-rush current is limited by the filter's inductor. The value of the rheostat R7 in the gate of Q3 should be $0.6/I_{trip}$; a 25-ohm resistance will trigger the SCR with 24 mA, while a resistance of 0.3 ohms will trigger the SCR with 2 A.

Overvoltage protection is provided by Q2. When the gate voltage exceeds 0.6 V, the SCR triggers and effectively shorts the output of the filter. The gate voltage is set by divider R5 and R6. Again, the current in Q2 lasts until the main circuit breaker trips. Q2 acts like a crow-bar placed across the output terminals of the filter.

The energy stored in the filter's capacitor and choke's magnetic field must be removed by the SCRs. Therefore, locating the SCRs after the filter but before the regulator minimizes the time needed to reduce the voltage to near zero, and protects the regulator as well as the load from overcurrents.

Designing a power supply is not a daunting task, although there are a lot of interrelated things to be traded off. From the theoretical point of view, power dissipation is a major item and the transistor data sheets must be read carefully. From a practical point of view, obtaining the wound parts, transformers and chokes, is a greater challenge.

A flexible bench supply can be built without a lot of head scratching. Or the trade-offs of a custom supply can be juggled with predictable consequences.

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QRP Asylum Update

The latest from our build-crazy ham ...

The decline of home equipment construction in amateur radio must surely rank as one of the more gradual of historical trends. In the September 1956 issue of CQ Radio Amateurs' Journal, *author Don Stoner W6TNS, gets on his soapbox: "Too many amateurs would rather put the green on the line and bring home a factory-made ham station, never more to get burnt by a hot soldering iron."*

Like those stories told by our grandparents of walking five miles to school each day uphill both ways in the snow, the truth about the beginnings of the "appliance operator" era and the decline of home-brewing is not so clearcut. In *Solid State Design for the Radio Amateur,* the eminently qualified home builders Wes Hayward W7ZIO and Doug DeMaw W1FB open their chapter on receiver design by pointing out that "by the time the 1930s arrived, it was common to find an amateur station with homemade transmitting equipment and a commercial-built receiver. This was the rule rather than the exception in the 1950s... ." They go on to say that the origins of the "appliance operator" era were really marked by the transition from homebuilt transmitters to factory-built transmitters during the rapid growth of the fairly complex single sideband technology.

One way to remove all guilt from "appliance operation" is to start scratch-building and operating your own equipment. For those who saw my last article ("QRP Drives Ham Nuts," *73,* 3/01), we built several transmitters from scratch and then some transceiver and basic receiver kits. Like the hams from the 1930s, we had a few problems with receivers. In this article, we'll try to reverse 70 years of history, and get some of these going.

W1FB Practical 20m DC Receiver, *W1FB QRP Notebook,* ARRL, 1991

Doug DeMaw W1FB says that simple receivers have a lot of flaws, but he has them in his books so that beginners can build their confidence and experiment. After salvaging several four-lead 40673 MOSFETs from some old CBs, I was ready to make another run at receivers. How much can go wrong in a receiver with just three active devices? This one went together easily on a piece of perforated board, which is apparently not a good way to build RF equipment (see the G3VA book summary below). This circuit design does not have an audio amplifier, so I used for the first time my Heathkit audio signal tracer, which was constructed and shelved over 25 years ago.

I heard a shortwave station right away, and had a feeling of pure joy as I listened, transfixed, for maybe half an hour. I also heard an incredibly strong image of our local AM broadcast station, so I built up the broadcast band filter from W4ZCB on page 169.

For the filter, I used a three- by one-inch piece of cheap phenolic perfboard, rejected by some as inferior to fiberglass perfboard, which you are not supposed to use anyway. Phenolic is cheap, you can buy it everywhere, and to my way of thinking it does not

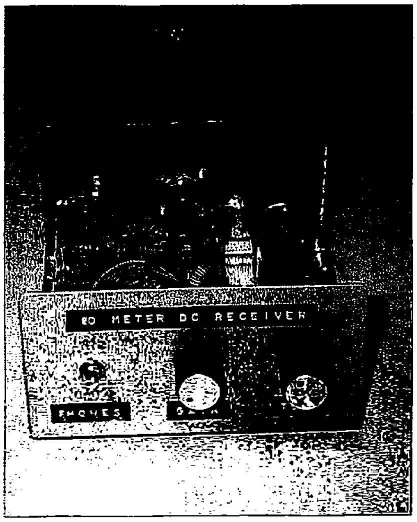

Photo A. *W1FB Universal DC receiver in a Radio Shack cabinet. Note the W4ZCB broadcast filter.*

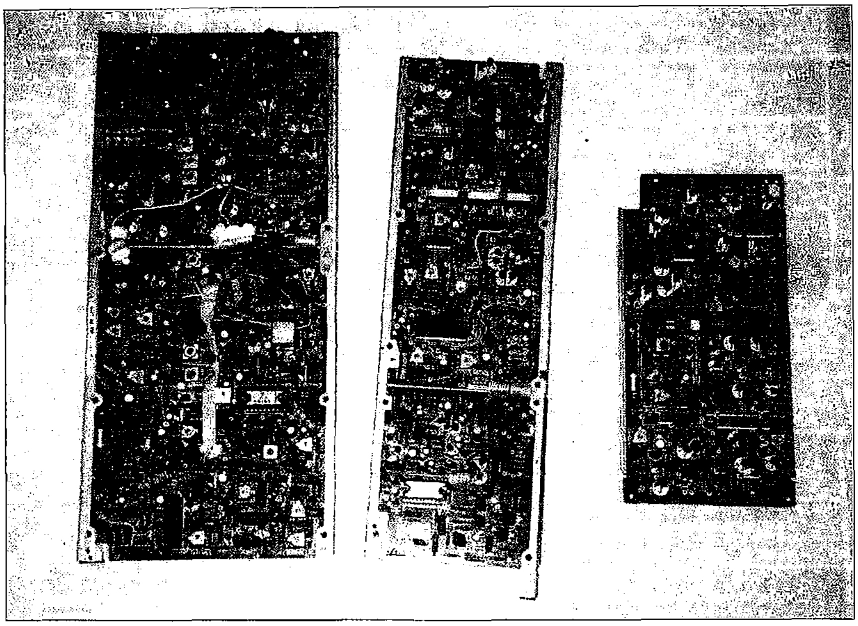

Photo B. Three of the seven boards from a 1986 vintage VCR — great source of QRP parts.

produce as toxic a dust when sanded or drilled, nor dull your drill bits as fast. Anyway, this design lets you keep the three RF chokes in the filter the suggested minimum of an inch apart, with one on each edge and one in the center. The add-on audio amp was another story — the text suggests the 741 op amp stage from Fig. 3-22. After two complete several-hour tries at that, I gave up and built an LM386 audio stage from Fig. 3-10 of the *W1FB Design Notebook* — success.

W1FB Universal Receiver (80m), *W1FB QRP Notebook,* ARRL, 1991 (note that the latest updated printing is 1999)

I was stymied on this one, in part by a mystery capacitor (C3), which did not have a value specified in my edition of the book. A helpful member of the Minnesota QRP Club suggested 100 pF, which was confirmed in an E-mail from FAR Circuits (who makes the boards), and on the corrected schematic in the newest, 1999, printing of the ARRL book. Probing the output with my signal tracer, I discovered that the front end was not working. The VFBO was not oscillating either, according to my Radio Shack frequency counter. I remembered only then that a 1 mH inductor is not the same as a 1 μH inductor. Once both of these were replaced with the specified values from the book, this receiver fired right up. I used a Dan's Miniature 10:1 Reduction Drive ($15.00), coupled to a home-made L-bracket on my tuning capacitor. This one also needed the high-pass filter from the back of the W1FB book to eliminate local AM interference, and works very well.

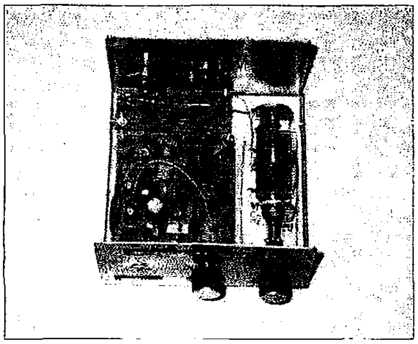

Photo C. W1FB Universal DC receiver with W4ZCB broadcast filter.

The WB8VGE Two-Fer (*73*, 4/1993, p. 53)

I was eager to get up on 20 meters. This one went together rapidly, but had two mysteries — an unlabeled cap on the diagram — which was on the base of the 2N3866 (it's 33 pF on the board layout), and no specification for wire gauge on the chokes and transformers. The board lettering says the key switch is a 2N3907, but the schematic suggests a (PNP) 2N3906. I guessed #24 on the wire, which is in an earlier Two-Fer article. The transformer is a small core that would not hold the 26 turns of #24 in a single layer, so I tried #26. Anyhow, it does not oscillate, and the 2N3866 just gets hot, so I'm not sure what is happening with this one. I did try two layers of #24 wire on the transformer — still nothing. My best guess here is that the crystals I have (I tried two) might be the wrong capacitance. So the idea would be to try to get the oscillator working by putting in some trimmer caps in the oscillator circuit. There was mention of a matching receiver — I am curious about that as well. I also went crazy trying to get the right leads on the metal TO-3 2N3866 matched up with the screening on the board, which was intended for the plastic TO-92 case.

Ramsey 30m Receiver

Like the other Ramsey kits I have built, this one is pretty basic but has good directions and goes together quickly. I had a bit of trouble aligning this one (the 80m version was a snap). After dragging out my signal generator, I found that I had failed to remove the internal capacitor on one of the IF cans as specified in the directions. With that done, the rig worked fine. If you have a good antenna and a tuner, these are OK but do not have enough gain to overcome a poor antenna. I ordered a multiturn pot for this radio, but will likely put my energy into building another W1FB Universal DC Receiver for this band.

Discarded VCRs as parts sources

Reuben Ruen WBØBWL, has been hearing of my QRP activities on his repeaters. He donated a collection of parts including a broken 1985-vintage VHS VCR. This one turned into a rich source of components. The one I got had over 35 marked RF chokes (these use the resistor color code; brown-green with black on the side is 15 μH). These have many small-signal transistors, diodes, NPO ceramic caps, and

even some trimmer caps; and a color burst crystal in each unit. I went out and bought five more for two dollars each from a local TV repair shop, which had at least 50 on hand. I have a small Pierce oscillator running on 80 meters with parts from one, and would like to build a VCR-only 80m transmitter or receiver. One difficulty is an interstage transformer — the easiest way to go is a with a mail-order toroid.

I got some data back from Radio Shack on their latest (#273-103C) 100 µH RF choke — actually, the core:

Element: Fe_2O_3 ZnO CuO MgO

Initial Permeability: 220

Saturation Magnetization: 2300 gauss (150e)

Residual Magnetization: 900 gauss

Coercive Force: 0.55 Oe

Loss Factor: 4×10^{-5} (0.1 MHz)

Temperature Coefficients of Ui: 15–40 x 10^{-5} (20–40 degrees C)

Curie Temperature: >150 degrees C

Specific Resistivity: 10^7 (omega — infinity)

Density: 4.7 g/cm^3

The idea would be to develop interstage transformers with that core. It would be fun to scrap out a VCR and turn it into a radio in an afternoon with no advance planning. Our 1930s-era hams would no doubt approve.

RSGB Technical Topics Scrapbooks
by Pat Hawker G3VA

The ARRL has started importing these, and I saw a copy at Radio City. I was immediately impressed by the sheer number of QRP schematics in each volume — after bookmarking 10 good projects in the 1990–1994 volume, I ran out and got the 1995–1999 volume. While Pat says he is not a QRP person per se, he gets all the various amateur and RF engineering magazines from around the world, and pulls the goodies out of them each month for his RSGB Technical Topics articles, which are captured in these scrapbooks.

That was where I learned that using perfboard for RF was bad (W1FB seems to think it's OK, though), and that tinning the ends of stranded wires before putting them on screw-type terminals blocks (which I have been

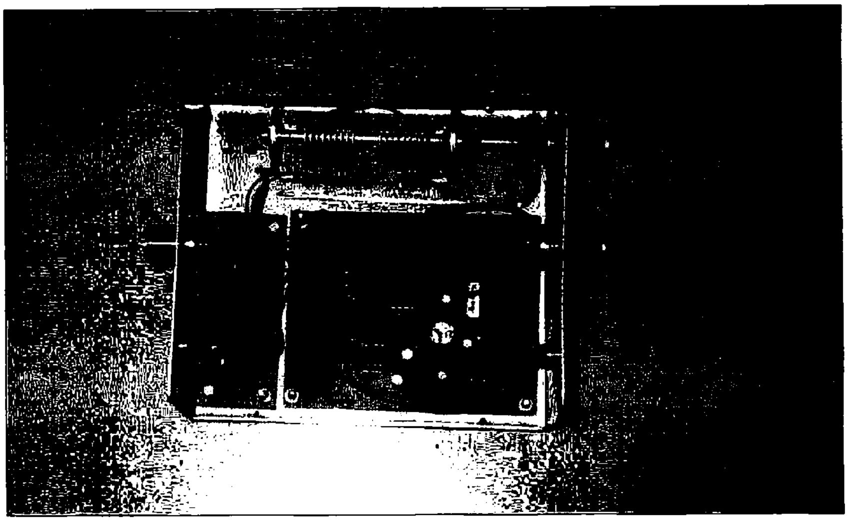

Photo D. View of W1FB Universal DC receiver in Radio Shack cabinet. Note reduction drive and W4ZCB broadcast filter.

doing for at least 25 years) will tend to cause the solder to cold flow and the connections to loosen and fail after a year. Pat was also around in the hobby for the beginnings of the W1FB/W7ZIO era, which I missed. I found a nice W7ZIO article on MOSFET power amplifiers, which had not revealed itself before under the rather basic indexing system on my ARRL *QST* CD-ROMs. There is only one minor annoyance with these books. When the RSGB redraws schematics, they use British component-value notation. I found an article in the book that I had in its original American form and built my own conversion table, shown in **Table 1**.

30m W1FB EX-1 Transmitter, *W1FB QRP Notebook*, ARRL, 1991 (note that the latest updated printing is 1999)

There is something confidence building about a PC-board-based project. All you have to do, in theory, is to gather up the parts and stuff them in. In this case I did just that, and nothing happened. I tried different crystals, and tested and rechecked every part. One time-saver is a transistor tester. I have a 20-year-old Radio Shack model, but they have a brand new one out for under $20. I finally noted a comment from W1FB about adjusting some of the caps in the oscillator to match the crystal. I put in some trimmers and got the crystal to oscillate, but did not get anywhere near full output. It runs great with my finger on one of the crystal terminals, hardly a practical solution.

More projects

As I write this, another stack of boards has arrived from FAR. These include another W1FB Universal DC Receiver, a W1FB 40m transceiver that I want to convert to 80m, and a W1FB Universal VFO. I also ordered the filter crystals for one of the more complex W1FB superhet receivers as well. I decided for the moment not to order the surface mount kit from the Norcal Site — after building and rebuilding several 1.2 GHz amplifier kits for a repeater project, I find I can now reliably solder and desolder surface mount parts. For desoldering you need a steady hand and a supply of top quality copper desoldering braid, with rosin from your local TV parts supplier.

Sources

Amateur Radio Consignment Center, 623 Prior Avenue North, St. Paul, MN 55104. (651) 644-3102. ARRL, [http://www.arrl.org].

ARRL QRP Notebook, Doug DeMaw, ARRL, First Edition, 1986. The AL Factor discussion is on page 64. (Out of print.)

CQ Radio Amateur's Journal, [http://www.cq-amateur-radio.com]. (The 1956 issue cited was edited by Wayne Green W2NSD.)

FAR Circuits, 18N640 Field Court, Dundee, IL 60118; (847) 836-9148 voice/Fax (boards and matching article reprints);[http://169.207.3.68/~farcir/index.htm].

Continued on page 57

100n = 0.1 μF
10n = 0.01 μF
3n3 = 0.0033 μF
1n = 0.001 μF
2k2 = 2.2 kΩ
1m5 = 1.5 megohms

Table 1. Conversion table.

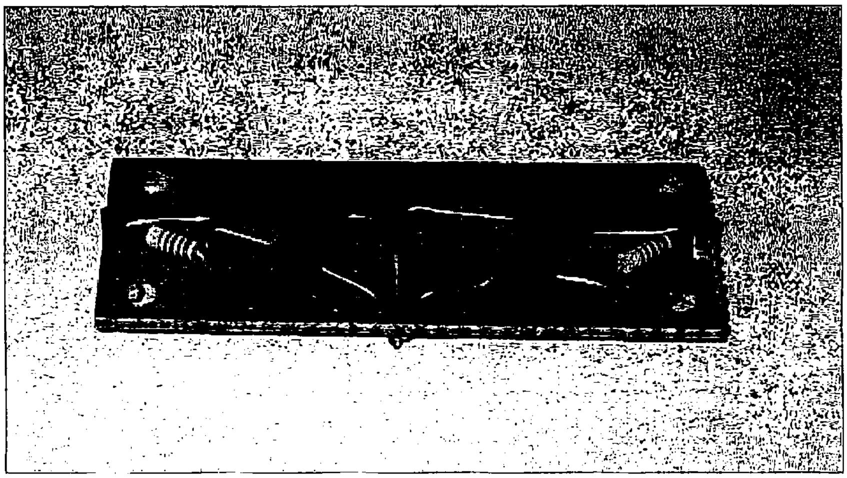

Photo E. High-pass filter from W1FB QRP Notebook *by W4ZCB, p. 169.*

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Your Long-Lost Transistor Notebook

Part 1 of 4.

Are you a tinkerer and experimenter who enjoys working with transistors? If so, then how do you work out the various parameters such as bias, resistor values, linearity, input/output impedance, gain, etc., that surround a transistor used in your circuits?

If you're like me, you want to go beyond just copying someone else's schematic when you build a project and tailor it to suit your needs. Yes, working with transistors in audio applications is pretty much cut and dried these days because most of the common circuit designs have been laid out in schematic form for us to follow. But if you'd like to see how some of the circuit values were derived, then let me take you on a tour of how transistors react and how you can derive most all of the circuit values for your next project.

Through the use of the "tools" developed during this tour, you will be able to characterize the transistors in your "junk box." After characterizing your transistors, you will be able to use them in projects of your own design with all of the correct values identified.

Our tour of "Long-Lost Notebook" will provide stops at the following subjects:

- Testing transistors
- Collecting data
- Plotting curves
- Characteristic curves
- Dynamic transfer characteristic curve
- Power dissipation
- Load lines
- Stage gain
- Linearity of operation
- QOP (quiescent operating point)
- Operating range (signal amplitude/limitations)
- Calculating resistor values
- Input and output impedance
- Frequency roll-off

The advent of the computer, and the myriad of computer programs available for circuit design, has taken the work out of setting up circuit values and removed all of the guesswork. But as an experimenter, it's nice to "see inside" the design and find out how and why the values were chosen. To get inside of the circuit, it's necessary to focus on how a transistor reacts to a particular electrical stimulus, and with the wide variety of transistors available, each will have its own set of reactions.

Working with transistors involves developing a set of "tools" that will allow a specific transistor to be examined. The oldest, and still the most useful, tools involve characteristic curves representing how a specific transistor responds to a surrounding set of circuit conditions.

To maintain a focus on understanding how a transistor reacts, the tour will be limited to Class-A transistor operation with audio signals. The transistor may react in a similar manner but the rules change somewhat when an RF environment exists.

Although some characteristic curves are available for some transistors, they are rarely published these days unless you have the opportunity to obtain data sheets from the device manufacturer. Even though the data sheets might be available, developing your own set of curves will tremendously increase your understanding of how a specific transistor will react. I've included several sets of characteristic curves in order to illustrate what the curve looks like and how they are used to examine a transistor. I've chosen three common NPN transistors and one N-channel FET as examples. **Fig. 1** shows the characteristic curves for a 2N3904, an NTE-69, and an MPF-102. **Fig. 2** shows three sets of curves for the 2N4401 representing three different Ic current ranges. The upper set of 2N4401 curves also shows the rated power dissipation of 310 mW.

Continued on page 28

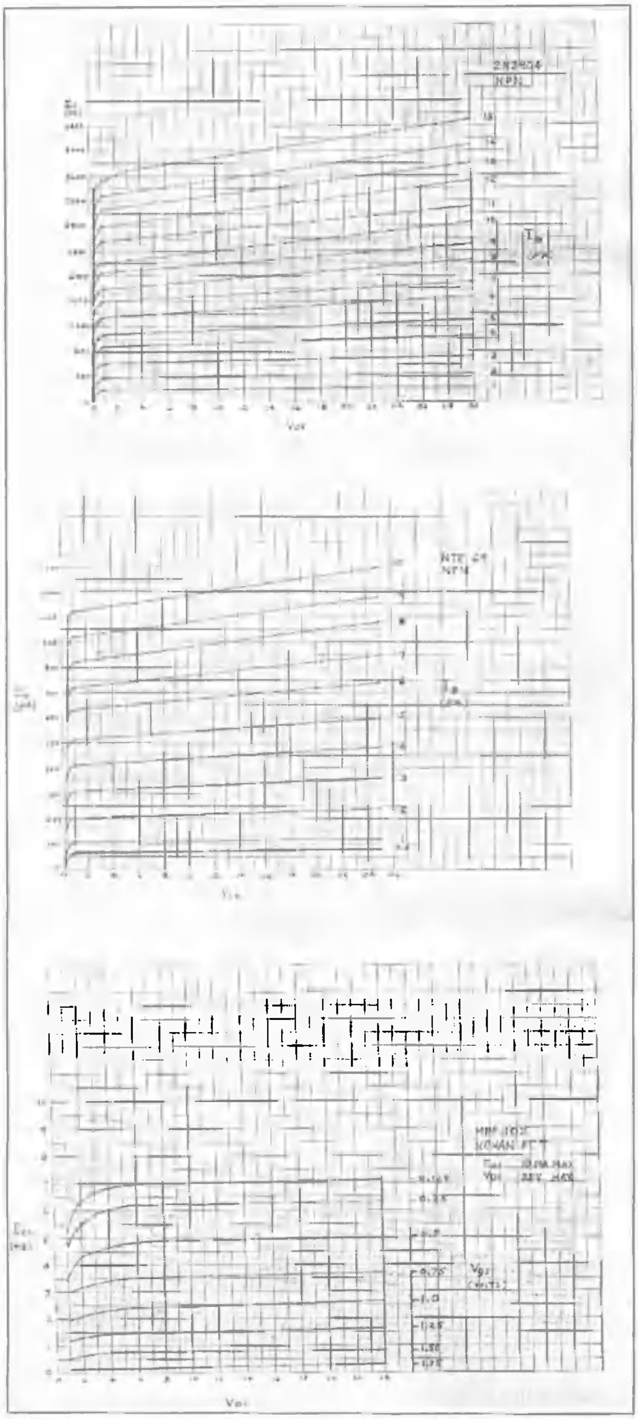

Fig. 1. Characteristic curves for two transistors and one FET: 2N3904, NTE-69, MPF-102.

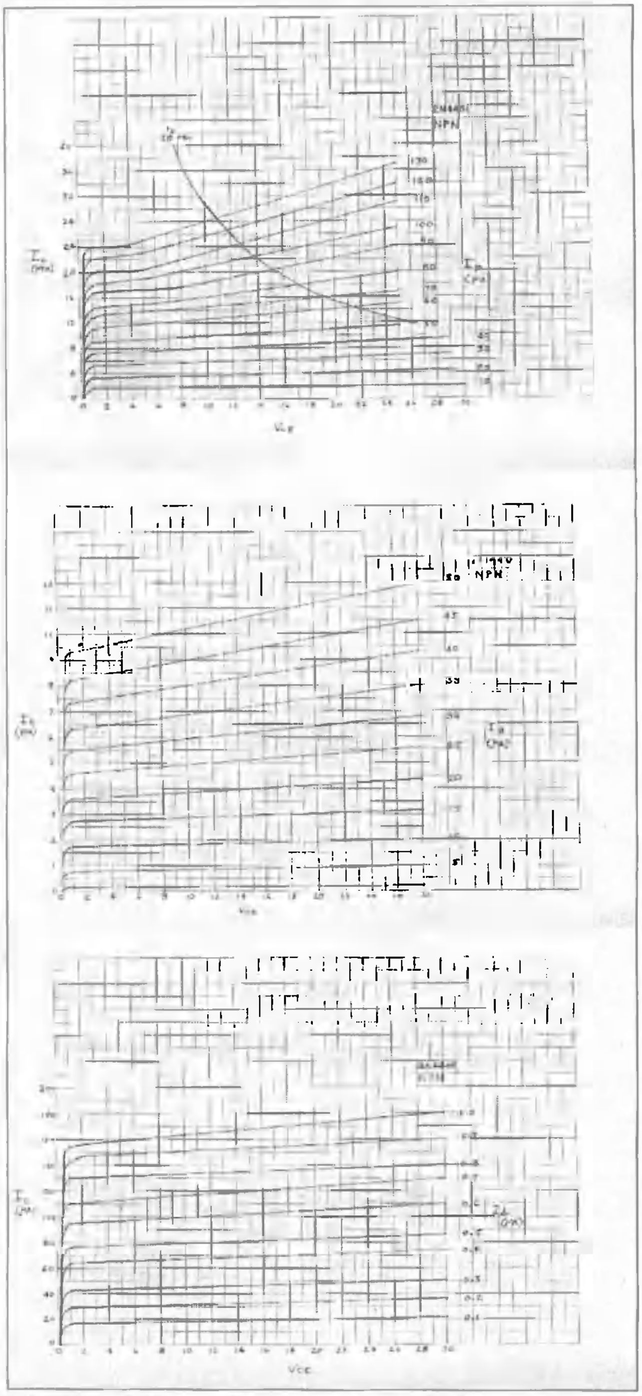

Fig. 2. Three characteristic curves for three different Ic ranges for a 2N4401 transistor. The upper high current set of curves shows the rated power dissipation curve for 310 mW.

Your Long-Lost Transistor Notebook

continued from page 27

The curves

Curves are plotted on graph paper in order to provide an easy means for reading and extracting accurate data. The two main coordinates for the charts shown in **Figs. 1** and **2** are Vce (voltage between the collector and emitter) and Ic (collector current). A curve is plotted using stepped values of Ib (base current) for all values of Vce and Ic within the operating range selected for the chart. As shown in **Fig. 1** for the 2N3904, the highest current is 4.4 mA and the highest voltage is 30 V even though the transistor may be capable of higher values. Other voltage and current limits may be selected to meet your desired circuit operating parameters, as shown in **Fig. 2** for the 2N4401. As indicated earlier, some transistors will operate at very low voltage and current values, and a set of

characteristic curves may be generated to support that application as shown in the lower chart of **Fig. 2** for the 2N4401. I've found it to be a lot of fun pushing transistors to their limit, particularly to the low current and voltage side of their capability.

Because usage applications vary somewhat between projects, curves may be generated with Ic values in the low, medium, and high ranges to meet the requirements of the project. One of the objectives of this tour is to provide the insight that allows transistors to be used to suit the project.

Although I'd used transistors for many years, I wasn't really aware of how low an operating current value might be and still have a transistor react correctly. With that in mind, I'd like to tell you a short story about low-current transistor operation that brought things into focus for me. Many years back, a ham acquaintance was operating a manufacturing company making heart pacemakers. Pacemakers operate off of battery power, and the battery is expected to last for very long periods of time. When we as experimenters build up a transistor circuit, we rarely give any consideration for the amount of current that the device draws because ample current is normally available from a power supply. But when discussing the current being drawn by the transistors used in the pacemaker, I was told that the current had to be limited to the very low microampere range in order to conserve battery life.

Stepping away from the pacemaker experience, the question arises as to how you determine the circuit values that continue to allow the transistor to operate at low current values. The first question that comes to my mind is what transistor will operate in the microampere region, and then how do you go about determining the circuit values to be used with it? Keep in mind that the resistors used in the circuit also draw current.

It's obvious that manufacturers' data sheets provide little if any insight into answering the questions regarding low current operation; therefore, it is up to the ham experimenter to set up a test for obtaining the desired information. Although it's unlikely that a ham would, in general, operate a transistor in the very low microampere region, it's certainly within his capability to evaluate the transistor at low current values if he desires to do so. The techniques provided in this tour are the key to answering many of the questions that arise.

Collecting curve data

Perhaps the most fun an experimenter will have with characteristic curves as a project is in developing a valuable database for the transistors that he has in the "junk box." If you're like me, you've collected transistors from circuit boards and other places, and have put them away for use in future projects. But many of those devices have strange part numbers that are not traceable to a data source. Well, now is the time to pull those transistors out of the "junk box" and find out something about them by developing a set of characteristic curves.

The test equipment needed to develop a set of curves for a transistor involves two variable voltage power supplies and three digital multimeters, along with a few selected resistors. **Fig. 3** shows the circuit that I've used to develop curve data for small-signal transistors such as the 2N2222, 2N3906, 2N4401, etc. **Fig. 4** shows the same setup modified slightly for developing the curve data for the MPF-102 N-channel FET.

My power supplies are built around LM-317 variable voltage regulators, providing a controlled output voltage from about 1.2–30V. Metering for my test circuits was done with inexpensive digital multimeters, but analog VOMs would work well.

Collecting data from the tests performed requires some uniformity and consistency in the way it is done. Because junction transistor characteristic curves are reasonably "straight" after passing to the right of the knee, only a few verification points need to be noted. Contrary to the above, however, if the power dissipation within the device rises and/or approaches the

Continued on page 30

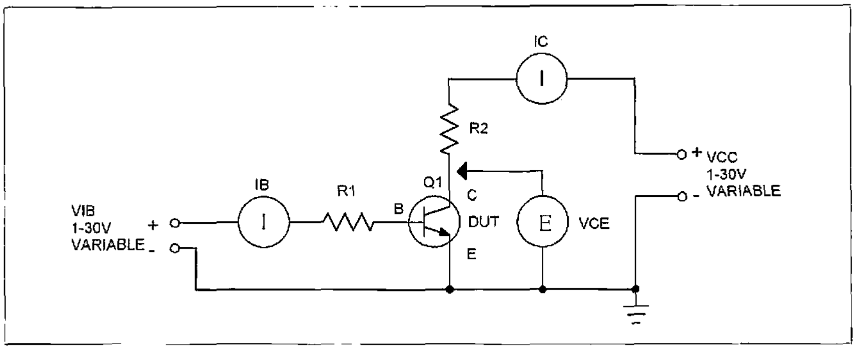

Fig. 3. Test circuit for collecting Vce-Ic characteristic curve data from junction transistors. R1 = 10k to 3 meg as needed. R2 = 150 ohms to 4.7k as needed.

Ib = _____	
Vce	**Ic**
0.5	
1.0	
5.0	
10	
15	
25	

Table 1. Suggested table used for collecting test data. A separate table is required for each base current value to be examined.

Your Long-Lost Transistor Notebook

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rated power dissipation, the plotted curves will arc upward with increased Vce values.

Table 1 shows a table format that is useful for collecting data; one is required for each base current value that is to be plotted. Base current values are selected for uniformity in incremental steps that apply to each transistor. The lower Vce values are used to identify the curve of the knee, and once found, only a couple of data points are then required to establish the slope of the curve.

Developing characteristic curve data for an FET follows a similar pattern as that of the junction transistor. However, the gate of an FET is voltage-operated, not current-, and the output (drain) characteristics are similar to those of a junction transistor.

To accommodate the voltage control of the FET gate, a voltage divider is used to establish the voltage applied. In addition, for an N-channel FET, the gate voltage polarity must be negative.

There are a wide variety of FETs available, and each type must be handled appropriately. The JFET, such as the MPF-102, is the easiest to work with when being tested using a simple test setup as shown in **Fig. 4**. A data table similar to the one shown in **Table 1** is used for collecting test data. It is necessary to collect a larger number of Vds test points for an FET because the curves are generally more "curved," not straight as shown for a junction transistor. A set of MPF-102 characteristic curves is shown in **Fig. 1**.

In preparation for running the tests and collecting data, the test setup and anticipated ranges should be verified in advance. To assist in obtaining the desired data prior to running the final test, the following steps are suggested to establish the desired data range:

1. Power supply voltages set to the lowest value.
2. Resistors connected correctly.
3. Meter ranges set and verified.
4. Sticky labels attached to the meters indicating Ib, Ic, Vce, respectively.
5. Raise the base current (Ib) to the first desired value.
6. Note the rise in Ic (collector current) as Ib is increased.
7. Raise the Vce power supply and note the rise in Ic. It may rise rapidly approaching the knee — and will rise slowly after passing the knee. Return the power supply setting to LOW.
8. Raise Ib to the highest expected value for the chart being developed.
9. Note the increase in Ic.
10. Raise Vce and note the rise in Ic. Is it within the desired value for the chart's upper current?
11. Should the Vce not rise to the desired upper value at maximum Vcc, then decrease the value of R2 and repeat step 10. Use the highest value of R2 that will allow Vce and Ic to reach the desired value for each curve.

NOTE: Power being dissipated by the transistor can be determined by multiplying Vce x Ic. The resulting power value must not exceed the rated value for the device.

12. When satisfied that the setup is operating as desired, run the test for each set of Ib values and record the data.
13. Return the Vce power supply to the lowest setting after each set of curve data is obtained.
14. Collect data for each transistor you desire to understand and in preparation for plotting the data on graph paper. Record the data in a format as shown in **Table 1**.

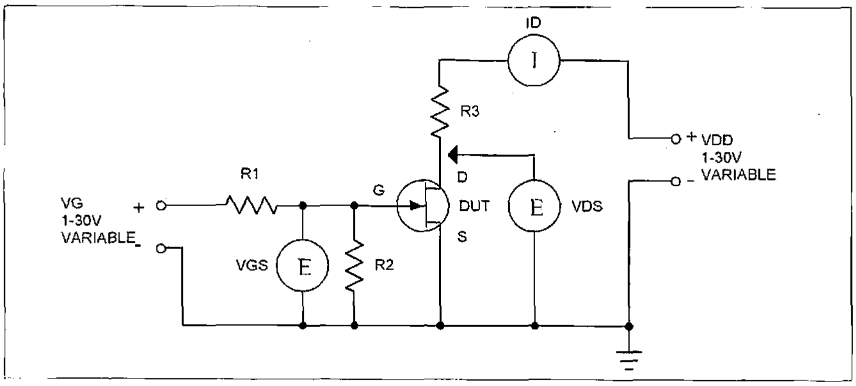

Fig. 4. Test circuit for collecting Vds-Id characteristic curve data from a junction FET. R1 = 1 to 5 megs as needed. R2 = 10k to 100k as needed. R3 = 150 ohms to 4.7k as needed.

Continued on page 57

Jim Pickett K5LAD
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Owasso OK 74055

Thumbs Up for ROTOR-EZ

This handy add-on fits inside *your control box.*

Back in the '70s, when I owned and operated a ham radio store, many of us in the ham population were excited when we heard that computers had become generally available. The year was 1975, and it was before the appearance of the Radio Shack TRS-80 Model I, the Apple, or the Commodore Pet. A company called MOS-Technology came out with a computer prototype board called the KIM-1, all neatly packaged on an 8.5" by 11" printed circuit card.

The KIM-1 had 1K RAM, 2K ROM, a hexadecimal keypad, and a line of 7-segment LED readouts along with lots of documentation; it sold for $289. The KIM-1 was designed for companies as a prototype board to allow them to experiment with the newly available computer technology. Quite a few hams, however, saw this new technology as a brand new experience, and were eager to get one.

I became a dealer for the KIM-1 line and sold dozens of these little boards, along with the wonderful handbook someone had written called *The First Book of KIM*. The question which was often asked by the less-than-excited customer was, "What can you do with it?"

I owned one of the KIM-1 boards, too, and was often asked that question. The easy answer was, "You can do EVERYTHING with a computer like this," but many wanted me to be more specific. The primary answer I used to give was, "As a ham, I can hook it up to my antenna rotator. Then, when I hear a station in a foreign country and need to re-orient my beam, I only need to enter their call and the computer will automatically look them up, determine their direction from me, turn my antenna to the correct position, and then shut itself off." Good answer, huh?

Now, almost exactly 25 years later, I am able to accomplish this task, thanks to the help of a new product from Idiom Press called ROTOR-EZ. It comes as a kit and can be purchased in either of two forms: the rotor control by itself or the same board complete with an RS-232 interface to allow attachment to a computer.

The ROTOR-EZ is designed for the Cornell-Dubilier Electronics (CDE), which later became Hy-Gain, and is now MFJ, Tail-Twister or Ham IV rotator. The primary reason for specifying those models is because they use the control box which has the individual switch paddles for turning clockwise or counterclockwise, and also has a separate switch for the brake. The earlier models of the CDE rotors used a single, center-positioned, direction control switch and did not have a separate switch to allow for controlling the brake.

The ROTOR-EZ board fits conveniently inside the rotator control box. There are few outward indications that the control box contains anything more than when it was received from the manufacturer, "at birth." The secret, however, lies inside the box.

The standard ROTOR-EZ board, which does not have the computer interface, allows the user to turn the calibration control pot on the rotor control box to set the meter to the direction in which they wish the rotor to point their array. Then, a tap on the brake paddle causes the rotor to begin turning. Rotation can be stopped at any time by another press of the brake paddle. A multicolored LED changes from red to

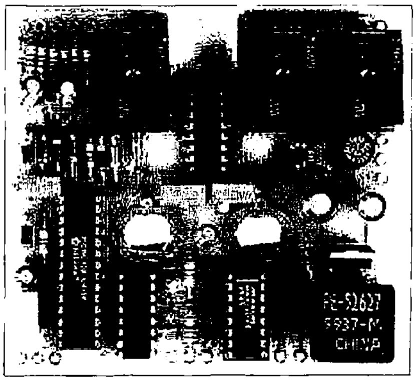

Photo A. *The photo shows the completed board. It is a well designed and attractive printed circuit board.*

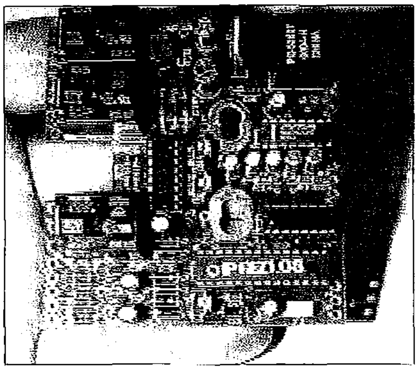

Photo B. The relays are on the left. The larger chip in the lower right is the programmed PIC.

orange to green as it approaches its final location. Watching the color of the LED lets you know how close you are to the final destination direction.

The board has several really nice features both built-in and user-selectable by using onboard jumpers. The 5-second brake-set delay is standard and very desirable to keep the brake from slamming into the internal stop grooves and damaging the tower, and/ or beam, and/or rotator. Note that if you have added a brake delay to your box already, it will need to be removed. One programmable feature is especially for the Tail-Twister rotor, which often has a hard time moving from an initial start command. If this feature is jumper-selected, the ROTOR-EZ will command it to go in the reverse direction for a second and then reverse direction to head off where you want it to go ... just like we have to do manually with a Tail-Twister. I thought that was an especially nice addition, since I am using my ROTOR-EZ on a Tail-Twister.

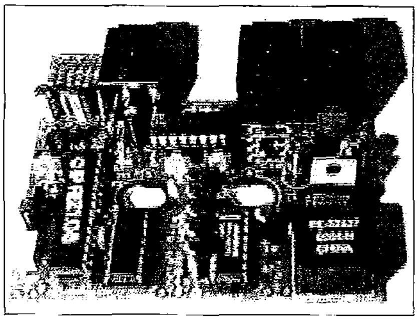

Photo C. The board is easily constructed when you take your time.

You can also jumper select a feature which removes power when rotation gets within 3 degrees of the destination point, to let your array coast to its final spot. Another jumper-selectable feature stops the rotor within 5 degrees of the end of rotation points to protect the rotor and tower from severe stress. Again, these are jumper-selectable,. and if you do not desire to implement them, you have that option.

A new programmable feature, which has been added to the latest version, is especially for those who have a 40 meter beam on the same mast as a beam for one or more other bands. Often, to counteract the interaction between these antennas, the 40 meter beam is mounted 90 degrees off from the tribander's heading. ROTOR-EZ can be wired so the meter shows the direction of the tribander or, by throwing an added switch, shows the direction 90 degrees from the standard display where the 40 meter antenna is aimed. This is user-selectable, and the switch becomes the jumper. Leaving the added switch off allows the display to work normally and display only the one direction. In the offset mode, one of the LEDs on the control box panel will blink a bit at a different rate so as to remind you that the display is showing an indication for the offset antenna and not the standard array. I did not try this feature, since I did not have a 40 meter offset beam on my tower.

The board can also be purchased with the extra components to allow RS-232 attachment and control. The board is prepared for the additional components and the silk-screening is there to show the appropriate parts placement. RS-232 interfacing is through a DB-9 connector attached to a short cable which is wired to exit the back of the rotor control box. The instructions suggest that if you buy the standard board and want to add the RS-232 feature later, this is easily done. Since I especially needed and wanted the computer interface, I chose the board kit with the RS-232 interface.

The ROTOR-EZ kit comes with a beautiful double-sided, silk-screened, glass-printed circuit board with plated-through holes. It was obviously professionally manufactured. The instructions

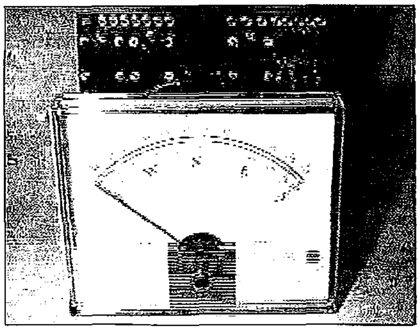

Photo D. The board shows from behind the body of the meter.

were clear and easily followed but the parts are small and my old eyes are not what they used to be.

Back in the 1970s, I remember building a BIG Heath color TV set from the kit — from unpacking to turning it on took me a total of 36 hours. Ah, the enthusiasm of youth. That, too, is a thing of the past. I spent something like 10 hours on the ROTOR-EZ board, checking and double-checking, reading and rereading, wiring, and checking some more. In my younger days, it would have taken probably 4–5 hours — tops. Since parts are small, polarities are important, and space on the board is tight, I chose to take a bit more time and use the old carpenter's axiom — Measure Twice, Cut Once.

A couple of the capacitors are accounted for in the instructions and have homes (and holes) on the PC board, but their locations are not silk-screened on the board. An enclosed letter from another ROTOR-EZ board builder commented about lack of silk

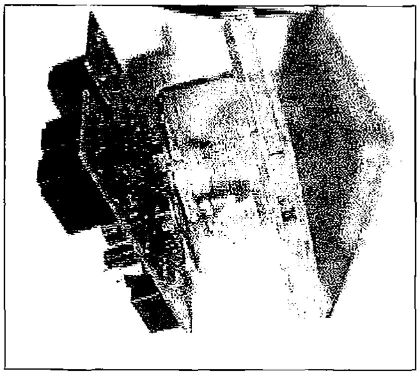

Photo E. The board attaches to the large screws on the rear of the meter — although the nuts had not been tightened when this picture was taken.

screening for these two components and, although I read that message, I placed one of the capacitors in the wrong spot anyway. There are holes on the board for jumpers, to customize the operation, and I mistakenly borrowed a couple of those jumper holes. I was able to catch the error during one of my rechecking or re-rechecking activities. Just a word of caution here should be sufficient.

The board uses a preprogrammed PIC chip and includes a socket just in case the user chooses to trade for a different preprogrammed PIC. The instruction sheet offers to burn a different PIC if the rotor used is on a side-mounted antenna setup which cannot (or should not) try to turn a full 360 degrees. The cost of this specialized chip was not given, but a call or an E-mail to the company should quickly provide that information.

The ROTOR-EZ board attaches to the two screw posts on the rear of the rotor control box meter. If there is already a board attached to your meter, as there was on my Tail-Twister control box, it must be removed completely with all its attached wires. The ROTOR-EZ board replaces the original board. The instructions caution the builder to make a sketch of where the wires go, just in case you should ever desire to put the box back to its original condition. I even removed the original LEDs (CW, CCW, Brake Release), since the kit came with new ones. This allowed me to keep all the wires on my original board. As a note, I placed a piece of white plastic tape on each wire and wrote to show where it had been attached. I'll probably never need to mess with that original board and its wires again, but if I did, those tape notes should save a lot of time.

The added multicolored LED is above the word BRAKE on BRAKE RELEASE. A hole must be drilled, and the LED and mounting hardware comes with the kit of parts. This is the LED that changes colors as the array turns from starting position to the final destination position.

One thing that troubled me in the design was the use of a small, nonstandard fuse on the board. The fuse is rated at 1.5 amps and is in a round can package like a TO-5 transistor. The two leads are soldered to the board. I certainly like the idea of fusing the board but if that device blows, I can't imagine the replacement being very quick or easy to locate. I hope I never have to worry about that.

My ROTOR-EZ is used with the logging program LOGGER by Bob Furzer K4CY, ex-N6BFM. Note that LOGGER is freeware, i.e., costs nothing. Bob had recently added rotor control to the program but nothing was mentioned about ROTOR-EZ. The two rotors that were supported were the Yaesu GS-23/GS-232 and the RC-28000 (M2 rotors).

I E-mailed the ROTOR-EZ company and asked if their board would work with the Ham IV and Tail-Twister rotors. Idiom Press quickly answered back that his board uses DCU-1 protocol, which was the same as with the Hy-Gain automatic rotor. He offered to correspond with the author of the LOGGER program about whether it would work. I gave him Bob's name and E-mail address and he sent Bob an E-mail inquiry including spelling out the protocol used by DCU-1 rotors.

In less than 45 minutes, I had a return E-mail saying that the new protocol had been incorporated into LOGGER and Bob needed someone to beta test that feature. The entire set of E-mails, from inquiry to having the new program which interfaced with the ROTOR-EZ board was less than 3 hours. Pretty neat, huh?

The LOGGER program is available for free download on the Internet, but at this writing, plans were being made to change to a different source due to heavy traffic. A quick search for LOGGER or logging programs should provide a place for you to download the program. As of the date this was submitted for publication, the URL to download the program was: [http://www.qsl.net/kc4elo/].

Cost of the standard ROTOR-EZ board is $99.95 plus $5 shipping in the USA ($10 for outside the USA. The same board with the additional components needed to allow RS-232 interfacing is $129.95 plus $5 USA shipping.

Photo F. The added LED shows between the two knobs and above the original BRAKE RELEASE LED.

The company has a Web site at [www.idiompress.com].

A recent trip to the Idiom Press Web page directs viewers to another site where, for a fee, the ROTOR-EZ kit will be built for you and/or installed in your rotator control box. This page also offered a list of troubleshooting suggestions, should you run into a problem.

If you have ever had the desire to incorporate a rotor-computer control, or to have a manual/automatic rotor control, or even to add a brake delay to your Ham-IV or Tail-Twister rotor, then ROTOR-EZ is for you. Automation is great when applied to the ham radio hobby. Let's see, now … all I need is some sort of device to actually make the contact …

Dan Metzger K8JWR
6960 Streamview Dr.
Lambertville MI 48144

Read All About It!

Part 8 of good stuff from The Hertzian Herald.

All about Babbage's Analytical Engine; Who's on first?; and What's in a name?

In 1833, Britannia ruled the waves. England's vast colonial empire was held together by the Royal Navy and the merchant marine. But ships were occasionally going to the bottom because the navigator said they were 100 miles from shore, when in fact they were literally on the rocks.

Navigation, at that time, was done by sighting on a few selected stars, checking the ship's chronometer (a very accurate — for the time — clock), and looking up your position in a book of navigational tables. (Sorry, no LORAN or GPS in 1833.) These tables were produced by rooms full of calculators — but at that time a calculator was not a pocket-size, or even desk-size, machine — it was a human being. Teams of calculators were hired to compute the values that went into the tables by hand, with pencil and paper.

Of course, these human calculators occasionally made a mistake, and that mistake occasionally resulted in a ship going down. The British Post Office, which seemed to be in charge of everything in England that wasn't nailed down, was not amused. So, when a gentleman named Charles Babbage told them that he could build a machine that would generate the table values and stamp them into printing plates — entirely eliminating the chance of human error — they gave him a pile of money and told him to go ahead.

Babbage called his machine a difference engine, because it produced its tables by using a process consisting mainly of a series of subtractions. It was to consist of hundreds of gears and levers, and was to be driven by a steam engine. Unfortunately, midway through the construction process, Babbage had a brainstorm.

"The difference engine can only do one job," he said. "But if I make it several times more complicated, I'll be able to configure or 'program' it to solve ANY mathematical problem. I'll call it the Analytical Engine." So he pulled his machinist off the difference-engine project, and told him to start over on the Analytical Engine.

This was not a good move, because (1) the requirements on the new system completely overwhelmed the precision available with the machine tools of the day, (2) Babbage was already involved in a dispute over who owned the tools that the machinist had developed for the project, and (3) the government was already balking at the cost of the difference engine. (Pushing the envelope of a new technology, a product that's obsolete before it goes into production, labor problems, cost overruns; where have we heard all that before?)

The end of it was that Babbage's projects were both canceled before they were fairly started, but computer historians agree that, if it had been built, the Analytical Engine would have been the world's first digital computer. It had all the essentials: a Central Processing Unit (he called it the Mill), a Memory (Store, to Babbage), Input, and Output units. Most important, it was to have its program stored in memory, a defining feature of the modern computer.

Babbage is generally credited with the invention of the digital computer, even though his design was never built, let alone operated. By this standard, Samuel Langley, or even da Vinci, should be credited with the invention of the airplane. Langley actually built

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a flyable plane before the Wright brothers, but a caught rope caused it to crash on its first trial. Langley's plane was rebuilt and flown after the success at Kitty Hawk, but we all know who gets credit for inventing the airplane.

Ada, Countess Lovelace, the niece of the poet Lord Byron, was an acquaintance of Babbage and a promoter of his inventions in the fashionable circles of London. Several moderns have attempted to cast her in the role of the first computer programmer. Alas, she never wrote a line of programming in her life — there was no computer to write a program for! But facts must never be allowed to get in the way of a romantic story. When the U. S. Defense Department set out to form a standard programming language several years ago, they called it Ada.

Who's on first?

The conventional American view is that nothing much happened in computers from the time of Babbage until the mid-1930s, when Howard Aiken began work on the IBM/Harvard Mark I, which was finished in 1944. The objective was similar to Babbage's, but with navigation under better control since the advent of radio, the tables to be calculated were ballistics — the aiming of big guns. A complete book of tables would require over two million 8-digit multiplications, an overwhelming task for humans. The Mark I was composed of motors, gears, and relays — a 51-foot-long, 8-foot-high monster. It did a 23-digit multiplication in 3 seconds. But it was not electronic.

J. Presper Eckert and John Mauchly at the University of Pennsylvania developed a fully electronic computer for doing ballistics tables, which became operational in 1946. It was called ENIAC (Electronic Numerical Integrator And Calculator), and was 1000 times faster than the Harvard Mark I.

It used 18,000 vacuum tubes, occupied a 30- x 50-foot room, and consumed 150 kW of power. It had a 100-kHz clock rate, and operated with decimal, rather than binary numbers. But it was "programmed" by hardwire patch cords. Real computers today are expected to store their programs in memory, the same as data.

The EDVAC, built in the next room to the ENIAC at the U of PA, came on line in 1950. It was the first operational stored-program electronic digital computer in the US.

Eckert and Mauchly started a computer company which was soon bought out by Remington Rand Corp. This company delivered the first commercial digital computer in the US in May of 1951. It was called UNIVAC, for Universal Automatic Computer. It contained 5,000 tubes, had a 2.25-MHz clock rate, and a memory of about 6 kilobytes. UNIVAC was used amid great fanfare to "predict" Eisenhower's election in 1952, and to "formulate" the questions for the popular TV quiz show, "The $64,000 Question." These stunts undoubtedly had much to do with the public perception of the computer as a "giant brain."

The above, as I said, is the traditional American view. Now, for some lesser-known facts:

1. John Atanasoff, at Iowa State College, was using vacuum tubes in a prototype digital computer in 1941. Mauchly visited Atanasoff in Iowa that summer, and the ENIAC surely owed much to what he learned there.

2. Konrad Zuse in Germany proposed a computer using 2,000 tubes for calculation of stress on aircraft wings. The Third Reich would not pay for the tubes, so he built, in 1941, a machine using 2,600 relays. It was successful, but was destroyed by an Allied bombing raid in 1945.

3. The British had built a computer-like machine to assist in breaking the German Enigma code in 1943. It contained 1,500 vacuum tubes, and was called Colossus. One of its progenitors was Alan Turing, who laid much of the theoretical foundation for later computer development, and whose tragic life was the subject of a PBS docudrama.

4. Kilburn and Williams developed a fully electronic, stored-program computer, which they called the Mark I, at the University of Manchester, England, in 1948 — predating the EDVAC by two years.

5. Ferranti, Ltd., in England, delivered a commercial electronic computer

Continued on page 57

Calendar Events

Listings are free of charge as space permits. Please send us your Calendar Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the September issue, we should receive it by June 30. Provide a clear, concise summary of the essential details about your Calendar Event.

JULY 4

BRESSLER, PA The Harrisburg Radio Amateur Club, W3UU, will hold its Firecracker Hamfest in celebration of its 29th year, at Emerick Cibort Park, Bressler PA. Set up on July 3rd from 6 p.m.–9 p.m., or July 4th at 6 a.m. The park opens to the general public at 8 a.m. July 4th. 80 covered tables, all with electricity, only $12 each, prepaid by June 1st. All tables paid for after July 1st will be $15 each, prepaid on a first come first served basis. 48 hour cancellation notice required for refunds. Contact *Pete deVolpi K3PD, 408 Hillside Ave., New Cumberland PA 17070. Weekday phone (717) 705-1370, weekends and evenings 6–9 p.m. (717) 938-8249. E-mail [w3uu@aol.com]*. See the Web site at *[http://members.aol.com/w3uu/]*.

JULY 7

OAK CREEK, WI The South Milwaukee ARC Inc. will hold its 33rd annual Swapfest on July 7th, at American Legion Post #434, 9327 S. Shepard Ave., Oak Creek WI. The event will run 6 a.m.–2 p.m. CDT. Free parking. Picnic area and limited overnight camping are available with plenty of nearby hotels/motels. Hot and cold beverages will be served. Admission is $5 for buyers or sellers. This includes a free "happy time." Talk-in on 146.52 simplex as well as on many of the local repeaters. A flyer with map may be obtained by writing to *The South Milwaukee Amateur Club, P.O. Box 222, South Milwaukee WI 53172-0102.*

JULY 14

LOVELAND, CO The Northern Colorado ARC will present the "Northern Colorado Superfest 2001" on July 14th, at the Larimer County Fairgrounds in Loveland CO. Doors open at 8 a.m. Talk-in on 145.115 rptr. Activities include swap meet, tutorials, demos, VE exams, and "QRP Corner." Guest speaker Paul Harden NA5N will give a presentation on Solar Activity and HF Propagation at 11 a.m. Admission $4, tables $12 each. To reserve tables, call *Rod Cerkoney NØRC, (970) 225-0117, or E-mail [n0rc@arrl.net]*. Vendor set up Friday at 5 p.m. and Saturday at 6 a.m. For more info see the Superfest 2001 Web site at *[http://www.qsl.net/n0rc/hamfest]*.

JULY 15

VALLEY FORGE, PA The Mid-Atlantic ARC will sponsor a hamfest July 15th, starting at 7 a.m. at Kimberton Fire Company Fair Grounds, Rte. 113, south of intersection with Rte. 23. Indoor-outdoor space: indoor tables with electricity 1–4 $10 each; 5 or more $8 each, not including admission. Tailgating $6, no reserved tailgate space. Admission $6. Talk-in on 146.835(-) and 443.80(+). Computer and electronics hobbyists are welcome. Write to *MARC, P.O. Box 2154, Southeastern PA 19399;* or call *Bill Owen W3KRB at (610) 325-3995.* E-mail *[gem@op.net];* Web site at *[http://www.marc-radio.org/hamfest.html]*.

WASHINGTON, MO The 39th Annual Zero Beaters ARC Hamfest will be held Sunday, July 15th, 6 a.m.–2 p.m., at Bernie E. Hillerman Park (Washington Fairgrounds). Free parking and free admission. Technical sessions, ham radio and computer flea market, ham radio demonstrations. Talk-in on 147.24(+) rptr. Watch for green on white hamfest signs. VE exam registration starts at 9 a.m. Walk-ins welcome, limit 60. Bring original license and a photo copy. For info SASE to *ZBARC VE Exam, P.O. Box 1305, Washington MO 63090.* For hamfest info, contact *Zero Beaters ARC, P.O. Box 1305, Washington MO 63090; 147.24(+) rptr.; Keith Wilson KØZH, (636) 629-2264, fax (636) 629-1196;* or *Bob Goza WØBOB, (573) 484-3718, [w0bob@arrl.net]*. Check the Web site at *[www.yhti.net/~w0bob/zbarc]*.

JULY 22

SUGAR GROVE, IL The Fox River Radio League will hold their Annual Hamfest at Waubonsee Community College, Rte 47 at Harter Rd., Sugar Grove IL (5 miles NW of Aurora). Doors open Sunday at 8 a.m. Set up Saturday at 7 p.m., Sunday 6 a.m.–8 a.m. VE exams at 10 a.m. Bring original license, copy of license, and photo ID. Talk-In on 147.210(+) PL 103.5/107.2. Contact *Maurice L. Schietecatte W9CEO, c/o FRRL, P.O. Box 673, Batavia IL 60510. Tel. (815) 786-2860, or E-mail to [w9ceo@arrl.net]*. The Web site is at *[http://www.frrl.org/hamfest.html]*.

JULY 27–28

OKLAHOMA CITY, OK The Central Oklahoma Radio Amateurs will sponsor "Ham Holiday 2001" at the Oklahoma State Fair Pk., northeast of the I-40 and I-44 intersection. This will be their 28th annual event. The event will be held in the Hobbies, Arts & Crafts/Modern Living Building. Doors open Friday, July 27, 5 p.m.–8 p.m.; Saturday, July 28, 8 a.m.–5 p.m. Features: Technical and non-technical programs, WAS card check, VE exams, flea market. Advance tickets $7, $9 at the door. Flea market tables $10 in advance, $15 at the door (if available). Electrical hookup $5. Talk-In on 146.82. Additional info and registration forms are available on the CORA Web site *[www.geocities.com/heartland/7332]*. Address other inquiries to *Ham Holiday 2001, P.O. Box 850771, Yukon OK 73085-0771; or E-mail [corahams@swbell.net]*.

JULY 28

CINCINNATI, OH The 4th Annual OH-KY-IN Amateur Radio Society Hamfest will be held July 28, 7 a.m.–1 p.m. at Diamond Oaks Career Development Campus, 6375 Harrison Ave., Cincinnati OH. This facility is located just east of I-275 and I-74. Take I-74 to the Rybolt Rd./Harrison Ave. exit (Exit #11). Go east on Harrison Ave. Diamond Oaks is located on the right (south side) of Harrison Ave., less than one mile from the I-74 exit. Special seminars, transmitter hunts, indoor vendors, outdoor flea market — first space free with admission ticket, additional spaces $3 each. VE exams at 8 a.m., walk-ins accepted. Free parking; handicapped parking available. Talk-In on 146.670(-) and 146.925(-) rptrs. Advance tickets $5, $6 at the gate. Age 12 and under admitted free. Indoor vendor tables (6-ft. with free electric) $10 each. Contact *Lynn Ernst WD8JAW, 10650 Aspen Place, Union KY 41091-7665, tel. (859) 657-6161; E-mail [wd8jaw@arrl.net]*. Web site at *[www.qsl.net/k8sch]*.

JULY 28

LINCOLN, ME The amateur radio community and the Bagley ARC of North Central Maine will be holding a hamfest, rain or shine, on July 28th, at the Ella Burr School in Lincoln ME. This is the club's 11th annual hamfest. VE exams will be held in the school complex. For more information contact *Hamfest Committee Chairman David Baker at (207) 794-3398.*

AUG 5

BERRYVILLE, VA Shenandoah Valley ARC will host their hamfest at Clarke County (Ruritan) Fairgrounds in Berryville VA starting at 6 a.m. on August 5th. Take I-81 at (Winchester) Exit 315 to Rte. 7 East (9 miles), bear right onto business Rte. 7 just before the traffic light. Fairgrounds on the left; OR Intersection of Rte. 340 and Rte. 7 in Berryville, go west approx. 2 miles. Fairgrounds on the right. ARRL VE exams at 1 p.m. Ruritan barbecue chicken dinners. Talk-in on 146.82. Admission $5, tables $12–$20. Contact *Brian Mawhinney WB3FUM, 2432-69 Berryville Pike, Winchester VA; (540) 665-0761.* E-mail *[WB3FUM@arrl.net];* Web site *[http://www.Vvalley.com/svarc].*

AUGUST 11

HUNTINGTON, WV Amateur radio and computer hobbyists from all over the mid-west will be in Huntington WV on Saturday, August 11th, for a giant hamfest and computer show at the Veterans Memorial Field House, 2590 Fifth Ave., 8:30 a.m.–2 p.m. The event is being sponsored by the Tri-State ARA. Tables paid for by July 31st are $8 each; $12 at the door (if still available). Call *Ezra Taylor N8KTA, (304) 429-1667.* VE exams at the Field House; be there by 10:00 a.m. for registration. All examination elements, written and Morse Code, where applicable, will be offered for all classes of amateur radio licenses. A fee of $10 will be charged per test. Pre-registration is not necessary but applicants must present two forms of acceptable identification, including one picture ID. Bring the original of any ham license currently held, and any Certificate of Successful Completion of Examination (CSCE) to claim credit from a previous exam. *Garry Ritchie W8OI,* leader of the TARA VE team, may be contacted at *(304) 733-1300,* for further details.

AUGUST 12

PEOTONE, IL The Hamfesters Radio Club Hamfest, featuring amateur radio, computers, and electronics, will be held at Will County Fairgrounds in Peotone IL. Exhibits open at 8 a.m. in a fully air-conditioned building. Flea market open 6 a.m.–3 p.m. No additional charge for flea market space. Set up Saturday, August 11th, 1 p.m.–11 p.m. Advance tickets $5 w/double stub, $6 at the gate w/single stub. Children under 12 free. For advance tickets (SASE and check by July 25th), and info, contact *Robert Nelson WB9WFR, 1720 Vollmer Rd., Flossmoor IL 60422; tel. (708) 756-7984,* or E-mail *[WB9WFR@aol.com].* Talk-in on 146.52 simplex and 146.64(-107.2) STARS rptr.

AUG 18–19

HUNTSVILLE, AL The Huntsville Hamfest and Alabama ARRL Section Convention will be held Saturday and Sunday, August 18th and 19th, at the Von Braun Center, 700 Monroe St., Huntsville AL. Admission is $6, under 12 free. Doors open both days at 9 a.m. VE exams will be held both days at 10 a.m. Forums include ARRL, MARS, Skywarn, QRP and more. Convenient parking. Giant dealer/manufacturer show, huge flea market, E-Z drive-in vendor unloading, DX banquet and more. Friday and Saturday night hospitality rooms at the Huntsville Hilton. Talk-in on 146.94(-), call K4BFT. For special hamfest rates at the Huntsville Hilton, call *(256) 533-1400.* Other contacts: Dealer show, (256) 536-3904; flea market (256) 883-2760; Forums *(256) 539-8950;* DX banquet *(256) 721-5996.* For general info call *(256) 880-8004.* Visit the Web site at *[www.hamfest.org].*

AUG 25

LaPORTE IN The LaPorte ARC will host the LPARC Summer Hamfest Saturday, August 25th, at LaPorte County Fairgrounds, State Road 2 west of LaPorte, 7 a.m.–1 p.m. Admission $5, tables $10, outdoor tailgating $2. Talk-in on 146.52 and 146.61(-) PL 131.8. For more info contact *Neil Straub WZ9N, P.O. Box 30, LaPorte IN 46352; tel. (219) 324-7525.* E-mail *[nstraub@niia.net].* The Club Web site is at *[www.geocities.com/K9JSI].*

SPECIAL EVENTS, ETC.

JUNE 30–JULY 2

DeSMET, SD The Huron ARC, and the Lake Area Radio Klub, will host a special events station to celebrate the 30th Anniversary of the "Little House on the Prairie" Pageant. They will be on the air 1600 UTC June 30–0200 UTC July 2. Frequencies: 7.265, 14.265, 21.365, 28.465 and 50.165. To get a certificate or a QSL card, write to Huron ARC, P.O. Box 205, Huron SD 57350 USA; or Bill Kerker [Wa0tdk@arrl.net]. Tel. (605) 352-1577.

JULY 20–22

IRVING, TX Seven members of The Jim Smith Society will operate station W9JSS at the 31st annual Jim Smith convention, July 20, 21 and 22, in Irving TX. The society has about 225 FCC licensed members. Contact W9JSS and receive a unique QSL card — one name with seven different callsigns. Try 14.280, 21.380 or 28.380 +/- QRM, 1530Z–1730Z all three days. Requests for a QSO on other bands, or other times, can be sent to *[JimWB9UKK@aol.com].* For more info about The Jim Smith Society, check the Web site at *[www.jimsmith2.org].*

JULY 21

OGDENSBURG, NY The Ogdensburg ARC K2RUK, will sponsor a special event station Saturday, July 21st, to celebrate the maiden voyage of the USCGC Maple WLB-207 to Sitka Alaska, and its visit to Ogdensburg NY (the home port for 17 years of its namesake USCGC Maple 234). The event will start at 1800Z and end at 2400Z. Frequencies: 7.240 and 14.240 MHz ± QRM, to run simultaneously. For a certificate, send a 9 x 12 SASE to *Walt Brady N2YMY, 17 Birch Hts., Edwards NY 13635 USA.*

AUG 18–20

42nd ANNUAL NEW JERSEY QSO PARTY The Englewood ARA, Inc. invites all amateurs the world over to take part in their 42nd Annual New Jersey QSO Party. Rules: (1) The time of the contest is 2000 UTC Saturday, August 18th–0700 UTC Sunday, August 19th, and 1300 UTC Sunday, August 19th–0200 UTC Monday, August 20th. (2) Phone and CW are considered the same contest. A station may be contacted once on each band — phone and CW are considered separate bands. CW contacts may not be made in phone band segments. New Jersey stations may work other New Jersey stations. (3) General call is "CQ New Jersey" or "CQ NJ." New Jersey stations are requested to identify themselves by signing "De NJ" on CW and "New Jersey calling" on phone. Suggested frequencies are 1810, 3535, 3950, 7035, 7235, 14035, 14285, 21100, 21355, 28100, 28400, 50-50.5, and 144-146. Suggest phone activity on the even hours; 15/10 meters on the odd hours [1500–2100 UTC]; 160 meters at 0500 UTC. (4) Exchange consists of QSO number and QTH (state/province or country). New Jersey stations will send county for their QTH. (5) Scoring: Out-of-state stations multiply number of complete contacts with New Jersey stations times 3 points per QSO times the number of New Jersey counties worked (maximum of 21). New Jersey stations multiply number of complete contacts times 3 points per QSO times the multiplier. The multiplier is the sum of the number of states (other than NJ), Canadian provinces, and NJ counties worked. Maximum is 49 + 13 + 21 = 83. (6) Certificates will be awarded to the first place station in each New Jersey county, state, province, and country. In addition, a second place certificate will be awarded when four or more logs are received. A total of two plaques have been donated by the ARRL Section Managers for NNJ and SNJ to the highest scouring single operator station residing in each of their sections. (7) Logs must show the UTC date and time, QSO exchange, band, and emission, and be received no later than September 15th, 2001. The first contact for each claimed multiplier must be indicated and numbered, and a check list of contacts and multipliers should be included. Multi-operator stations should be noted and calls of participating operators listed. Logs and comments should be sent to *Englewood*

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Andy MacAllister W5ACM
14714 Knights Way Drive
Houston TX 77083-5640

Hams in Space

During the 1970s, the focus at NASA was on moon missions and Skylab. One of the Skylab astronauts, a ham, thought it would be great to take a ham transceiver along into space. NASA thought otherwise. It wasn't until the early days of the Shuttle program that this astronaut, Owen Garriott W5LFL, would get his chance.

On November 28, 1983, the Space Shuttle *Columbia* went to orbit with the first manned amateur radio station, W5LFL. The radio was a specially modified 4.5 watt Motorola MX-300 2-meter transceiver built by the Motorola Amateur Radio Club in Florida. Volunteer Lockheed employees crafted a directional ring radiator antenna that could be fitted inside specific shuttle windows. There were a number of battery packs for the radio, cables, a headset, and a small tape recorder to complete the station.

During the 10-day mission, Owen found time for almost five hours of ham activity. There were 350 verified two-way contacts and over 10,000 SWL (Short Wave Listener) reports from 23 countries. It was an exciting and highly successful debut for hams in space. The SAREX (Shuttle Amateur Radio EXperiment) group continued to work with NASA and individual astronauts for over two dozen ham-in-space missions during the next 16 years. While contacts with schools were the primary goal, an increasing number of hams around the world managed to make random contacts with the astronaut hams.

While two meter FM voice operations were very popular, additional systems were tried. Specially configured AX.25, 1200-baud packet provided a mode that allowed an unmanned system on the shuttle to establish verified two-way contacts with ground stations. Other experiments included SSTV (Slow-Scan TeleVision) and FSTV (Fast-Scan TeleVision). The SSTV was very popular and easy to receive on the ground since it only required normal audio bandwidth via the 2-meter HT. The FSTV was more of a closed test with predetermined stations that sent video to the shuttle using AM TV in the 70-cm ham band.

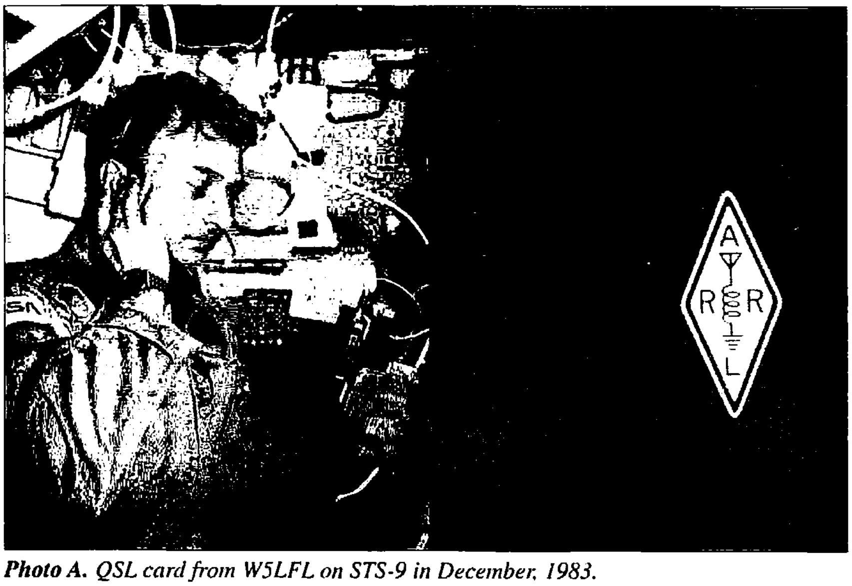

***Photo A.** QSL card from W5LFL on STS-9 in December, 1983.*

Next stop — MIR

When the Soviet Union launched the first component of the MIR Space Station on February 19, 1986, no one knew that this five-year project would extend into 15, and that ham radio would be on board within two years, in a big way. MIR was intentionally brought back to earth on March 23, 2001. The fiery reentry marked the end of a highly successful mission in space by the Soviet Union and Russia.

While the ion trail left by MIR may have provided some meteor- scatter-like propagation, it also represented the end of a lot of ham gear. Miles Mann WF1F of MAREX-NA (Manned Amateur Radio Experiment, North American Division) listed the equipment that was onboard at the end on his Web page [http://www.marex-na.org]; ICOM 228H transceiver, ICOM 70-cm repeater, Kenwood TM-733 dual-band FM transceiver, Kantronics KPC-9612 packet TNC (Terminal Node Controller), PacCom TNC, and the popular SSTV (Slow Scan TeleVision) system.

While ham communications with the Shuttle were limited to short-duration flights, operations with MIR were almost continuous. When a new crew of cosmonauts (and sometimes astronauts) went up to MIR for their tour of duty, activity via the ham gear would stop or slow down for a while. Inevitably though, after a few days or weeks, the new MIR residents would look to the ham gear for live leisure conversations with amateurs on earth. When crew members were not available for voice operations, the packet system, the 70-cm repeater, or the automatic SSTV equipment would be on the air.

And now for ARISS

The ARISS (Amateur Radio on the International Space Station) program represents a logical extension of Shuttle and MIR ham activities. Partner countries include groups from the USA, Russia, Japan, Belgium, France, Germany, Italy, Portugal, and Canada. ARISS has two principal goals: to provide school contacts from Space Station Alpha, and to promote general amateur-radio operation from space.

Ham activities in early 2001 included school contacts, scheduled family contacts for the astronauts, and a few random ham QSOs. Later in the spring, the packet system was activated. Unfortunately the TNC's internal battery had given out and all of the packet settings had defaulted to their "factory" setting. This meant that the system was identifying itself as NOCALL, but the digipeat function was on. Rather than turn the system off till the laptop that was loaded with the appropriate TNC settings could be repaired, it was decided to leave the packet system on-line. This delighted those of us on the ground who wanted to experiment with the gear, and perhaps use it for short packet contacts with others within the coverage footprint.

There are only a few frequencies to remember for 2-meter ARISS activity: 144.49 MHz voice uplink, 145.99 MHz packet uplink, and 145.80 MHz for all downlinks. The hand-held Ericsson M-PA series transceiver is capable of operations anywhere within the range 144 to 146 MHz, but the noted frequencies are those used for general ham contacts. If you hear ISS astronauts on other frequencies, they are either participating in school contacts or personal communications. Try another pass if you want a contact, or monitor the 145.80 MHz downlink in case they finish with their scheduled activity and want to make a few general QSOs while still over your area.

The USA voice callsign is NA1SS. Russian callsigns include RSØISS or RZ3DZR for voice, and when a laptop is available to get the TNC straightened out, the packet mailbox call will be RZ3DZR-1. Keyboard packet operations will use the callsign RZ3DZR. An excellent description of the complete ham radio system on the space station can be found at the ARISS Web page: [http://ariss.gsfc.nasa].

The radio system is located in the Russian Service Module — hence the predominance of Russian callsigns. The antenna is a special multiband unit that is clamped to an EVA (Extra Vehicular Activity) handhold on the outside of the Service Module. Signals are usually very good from this arrangement.

It doesn't take a lot of power to make contact with ARISS, but competition from other hams is usually the limiting factor.

Continued on page 58

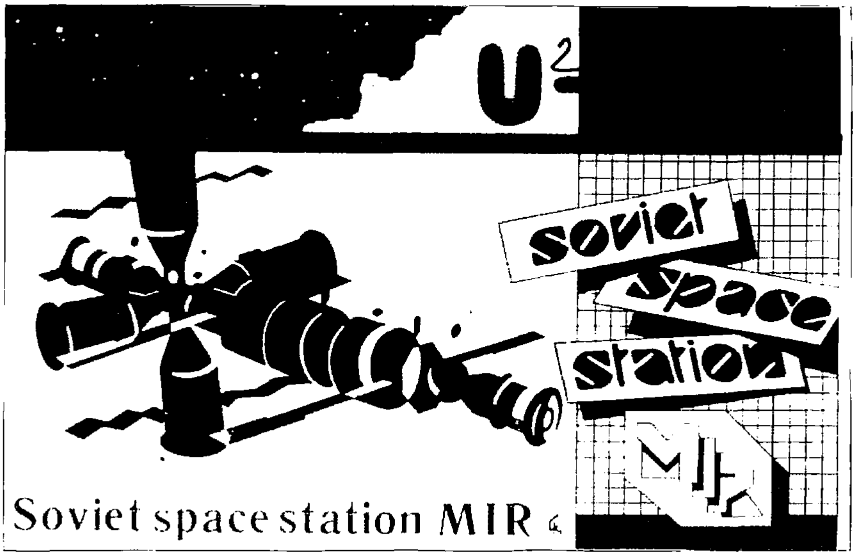

Photo B. QSL card from U2MIR on MIR in November, 1988.

N5VFF-1>DM79, NOCALL* <UI>:N9AB - hi andy, here brian
WD4OZN>EM55, NOCALL* <UI R>:whats ur qth andy
W5ACM-2>EL29EO,NOCALL* <UI R>:hi brian!
K5PK>EM96TD, NOCALL* <UI>:
N9AB>CQ, NOCALL* <UI>:qTH EN52xg
KD4RDB>APRS, NOCALL* <UI>:
W5ACM-2>EL29EQ, NOCALL* <UI R>:
K5PK>EM96TD, NOCALL* <UI>:
W5ACM-2>EL29EQ, NOCALL* <UI R>:hi k5pk
K5PK>EM96TD, NOCALL* <UI>:Hello ACM
N5UXQ>CQ, NOCALL* <UI R>:de N5UXQ, FM17ho, from Central VA
W5ACM-2>EL29EQ, NOCALL* <UI R>:Andy hr
K5PK>EM96TD, NOCALL* <UI>:Steve hr
W5ACM-2>EL29EQ, NOCALL* <UI R>:fb

Table 1. Example of early packet operation via NOCALL in space on April 14, 2001.

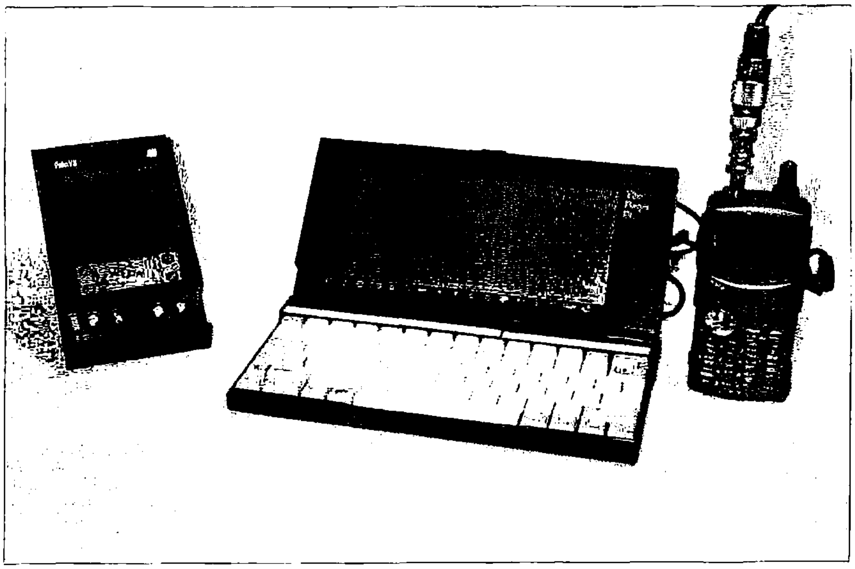

Photo C. At W5ACM the Palm VII plots the orbits, while the Poqet PC is used as a terminal with the Kenwood's internal packet TNC for ARISS communications NOW.

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More New Stuff

Here's what's new. I talk to a lot of hams with the multimode controllers sitting around, and they are straining to get modern "bells and whistles"-style software to run on their old computers such as the one I am using and older.

Most of my ham friends, and that includes you readers, realize that I use some old, clunky computers. I have one in the house that is a bit faster, but for the *real* work, I use this 120 MHz CPU with 32Mb RAM. A few years back that would have been considered blazing fast. Now ... Well, recently, one of my buddies, who enjoys heckling, asked if I needed any software upgrades for my Commodore 64. Hmmpf.

All kidding aside, there is a reason for using this machine. If it will run on this, you can be pretty well assured that it will run on that new whiz-bang computer down at the bargain center with the giga-whatevers inside.

Since I fall, at least partly, into that same category, I discovered a welcome answer. Though I have a lot of stuff that works pretty well, the new packages are often geared for the high-horsepower processing units.

The solution

The folks at Creative Services Software ([www.cssincorp.com] in *The Chart*), have worked out new packages that take advantage of the older controllers such as my PK-232MBX and the Kantronics and MFJ multimode units that will have you thinking you are flying a super-computer.

The packages run under the familiar Windows platforms, have interfacing logging modules, and also run PSK31 all in the same boot-up. That is, if you do it right, you can boot the programs and run the course from RTTY, Pactor, CW, and other modes that make your old controller come alive to a very well done PSK31 module with a few clicks and a switch. I will describe in a minute.

The price of the software may just be the reasonable alternative to buying new gear and starting from scratch with a new computer. I don't know about your computer, but I would hate to think of the hours it would take to set up a new computer to do what this one does (that is another story).

The real story is that I have been working with a pre-release version of this software for my PK-232MBX and the more I use it, the more I like it. As I said, the PSK31 module is impressive. It does employ the soundcard, as do other programs for this mode, and simply uses the PK-232 MBX for PTT in that mode.

What impressed me was its sensitivity, and ability to lock on to just about any signal in the tuning display if I clicked somewhere reasonably close to the signal trace. It has a feature I would have passed off as a novelty once upon a time, but I find the combined waterfall and spectral display a great way to go. I usually prefer the spectral display for determining the strength of a signal and showing the center to click, but I prefer the waterfall to watch for a new signal to show up that might be a new station calling CQ.

The PKTerm software displays one above the other as you can see in the accompanying screenshot. You get the best of both worlds and I like that. The combined display only took a few minutes in action to move from sense of novelty to full-blown necessity.

The macros took me a bit to get used to. Fortunately, the option to invoke macros with keystrokes is there, as well as "transmit" and "receive." Or you can go at it via

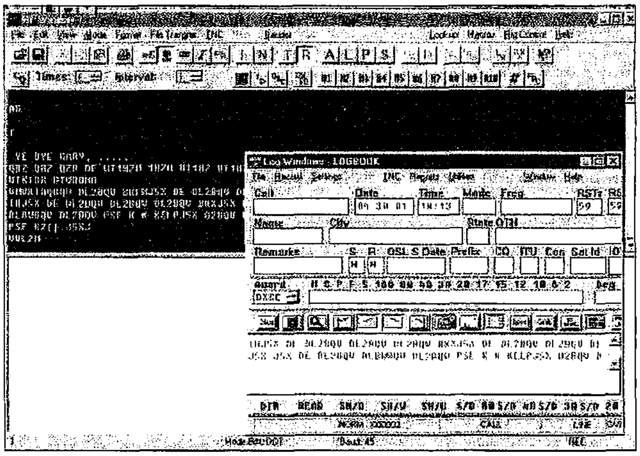

Fig. 1. Screenshot 1 — This is the log program reduced to fit over the communications program. You can see the received text is displayed in both windows. If you have a larger monitor, these can be side by side. Once you have established contact, you can maximize the Log Windows panel and simply carry on from there, sending and receiving text and doing the "overs" with the function keys. The Log program has rig control as well as rotor control, allowing you to automate your station to whatever extent you desire. Rig control speeds up the action as the mode and frequency are automatically inserted along with the time and date which is supplied by the computer. If you are using an older controller that cannot simultaneously access the packet cluster and the HF mode in the controller, the system has provision and instruction to set up AGW packet engine to run from a separate serial port. This shot was taken late in the morning here in the west, and 15 meters was the hot band of the day. The received sigs were barely moving the S-meter and yet, as you can see, the RTTY print was excellent.

the slower and more deliberate mode by clicking buttons and menus.

Speaking of additional modes. Well, I shouldn't say it that way. The multimode controllers all do packet. However, the really old stuff, such as the PK-232MBX, cannot simultaneously run packet, as to a DX cluster, while working one of the other modes such as RTTY. There is a plan, described in the Help Files, to use the AGW software through a separate serial port to accomplish this slick trick. So here is another place to save a few bucks. In my case, I need to add serial ports and the whole operation will dovetail while eliminating the need to spring for a later controller.

The Help File is well written and contains about all you need to get over any of the humps for setup and operation. I downloaded the optional Operating Manual in Adobe Acrobat format. I find it is less frustrating to have a handful of hard copy than to guess at the jargon some of the documentation folks put in the Help Files. That is just a rule that works for me, not a criticism of these Help Files; it is an automatic procedure. However, you may wish to skip that part when I tell you the Manual printed out to nearly a hundred pages. It is, by certain standards (mine), recommended reading.

Easy setup

On to success. This really is not difficult software to set up. In the case of the PK-232MBX, I am always a bit hesitant with new software because there are so many parameters that one can mess with and get wrong. Well, my fears were for naught; the software has its own set of parameters that just plain work. That means, install software and follow the directions, such as, and mostly limited to, start the program.

You will have to set the Comm port and possibly the baud rate plus enter your callsign, and if you are to choose to operate AMTOR there is a selcal requirement. The automated settings are those other 100+ incidentals you just don't need to bother with. Though it is possible to tamper with them if you insist, but I did not find it necessary.

Once you have the program installed, you can start working the modes inherent to your controller, plus you will have the ability to operate PSK31 with the same software. The modes available from the controller work as well as, or better than, I have ever seen with any other software. The RTTY is very sensitive, plus it toggles transmit/receive quickly. I was copying and working stations that were not moving the S-meter with no additional filtering help in both RTTY and Pactor.

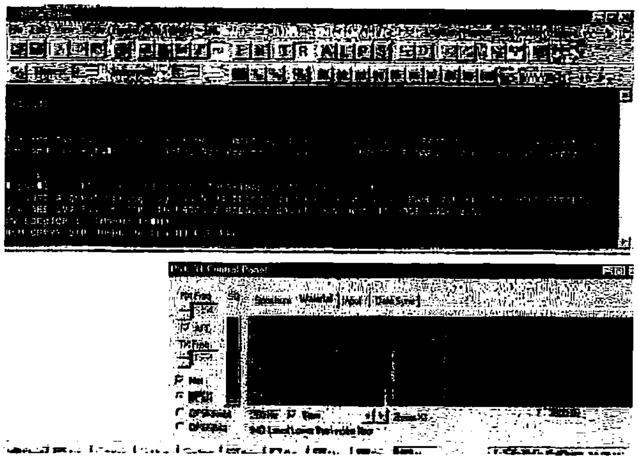

Fig. 2. Screenshot 2 — This is the program in the PSK31 mode. The PSK31 tuning module can be moved wherever works for you. In this case, I left it fully displayed so you could see all the buttons. This shot was taken within 15 minutes of the RTTY-Log screenshot, also on 15 meters. For a few minutes, there were about twice as many signals tracing down the waterfall. The EA4 signal is the trace that is no longer transmitting (about a third of it left on the waterfall display) below the dotted line just below the "Data" tab. The other two signals to its right not only are visible in the waterfall, but also in the spectral display directly above the waterfall. These were also weak signals that did little more than tease the S-meter. Two most impressive features are the ease of tuning and the remarkable sensitivity to received text. Signals have to be just about buried beneath the noise level to avoid readable print.

Now, I have to confess to a few things I did to make this setup a bit easier to handle. I realized I was going to have a conflict of hookups and would have to do some cable switching all too often if I didn't get serious about this lash-up. I made a little switchbox, which is a breakout box in the cable from the rig to the controller.

That way I can, with the flip of a switch, redirect the sound going to and from the rig to the controller and redirect it to the soundcard when I want to work PSK31. That seemed like a reasonable project, simple. But of course I saw another possibility, which led to a few more jacks allowing a route through the DSP 599zx. All this can be left hooked up or rearranged for different test purposes.

The switching was an excellent idea. I will never regret that part of the project. Strangely, other than the time spent experimenting with and optimizing the 599zx that part was not really a necessity thus far. The copy, as I said, has been phenomenal with no extra help. So take that as a plus for the caliber of the software.

I discovered I have excellent results with this software printing very weak signal RTTY as well as other modes. Therefore, there has not been a real need for additional filtering. Now, this is surprising, since all the time I have been using this software, even in the controller modes, I have left the filter wide open on the rig. And that has been wide as in the 3.0 kHz that works so well with the DSP soundcard programs I have been accustomed to using.

Continued on page 42

Source for:	Web address (URL):
Mix W Soundcard program for PSK31, RTTY, new modes, MTTY, FSK31, more	http://tav.kiev.ua/~nick/my_ham_soft.htm http://users.nais.com/~jaffejim/mixwpage.htm
FREE MMHam site — MMTTY — MMSSTV	www.geocities.com/mmhamsoft/
FREE VK7AAB — SSTV-PAL — PSK-PAL	http://users.origin.net.au/~crac/
Much ham info w/SSTV downloads	www.conknet.com/~kb1hj/index.htm
TrueTTY — Sound card RTTY w/ PSK31	www.dxsoft.com/mitrtty.htm
Pasokon SSTV programs & hardware	www.ultranet.com/~sstv/lite.html
PSK31 — Free — and much PSK info	http://aintel.bi.ehu.es/psk31.html
Interface for digital - rigs to computers	www.westmountainradio.com/RIGblaster.htm
Soundcard interface info — includes Alinco	www.packetradio.com/psk31.htm
Interface info for DIY digital hams	www.qsl.net/wm2u/interface.html
WinWarbler Info and free download	www.qsl.net/winwarbler/
MFSK-related tech info — how it works	www.qsl.net/zl1bpu/
Throb — New — lots of info	www.lsear.freeserve.co.uk/ www.blinternet.com/~g3vfp/
Download Logger, also Zakanaka	http://www.qsl.net/kc4elo/
PSKGNR — Front end for PSK31	www.al-williams.com/wd5gnr/pskgnr.htm
Digipan — PSK31 — easy to use	http://members.home.com/hteller/digipan/
TAPR — Lots of info	www.tapr.org
TNC to radio wiring help	http://freeweb.pdq.net/medcalf/ztx/
ChromaPIX and ChromaSound DSP software	www.siliconpixels.com
Creative Services S/W Multimode w/PSK	http://www.cssincorp.com/products.htm
Timewave DSP & AEA (prev.) products	www.timewave.com
Auto tuner and other kits	www.ldgelectronics.com
XPWare — TNC software with sample DL	www.goodnet.com/~gjohnson/
RCKRtty Windows program with free DL	http://www.rckrtty.de/
HF serial modem plans & RTTY & Pactor	http://home.att.net/~k7szl/
SV2AGW free Win95 programs	www.raag.org/index1.htm
Source for BayPac BP-2M & APRS	www.tigenronics.com/
Int'l Visual Communications Assn. — nonprofit org. dedicated to SSTV	www.mindspring.com/~sstv/
Hellschreiber & MT63 & MFSK16 (Stream)	http://iz8bly.sysonline.it
HamScope — multimode w/ MFSK16	http://users.mesatop.com/~ghansen/
YPLog shareware log — rig control — free demo	www.nucleus.com/~field/

Table 1. The Infamous Chart ... updated monthly.

The Digital Port

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There is more to this software than simply printing to the monitor and being heard. Speaking of being heard, I have gotten excellent reports on quality and readability, which I had neglected to mention earlier.

But the next phase of the program was probably the most impressive. There is a logging program dubbed Log Windows you must download from the same site. It has at least one feature that I feel is the result of inspired genius.

As you may recall, this station is monitor-challenged, with the smallest monitor commonly available for the wannabe computerist (13" diagonal). This leaves me at odds when it comes to displaying panels side by side. They overlap and become nearly unreadable in most instances. The result is that I must frequently click the hidden panel up from the task bar and see only a part of the action at a time.

This would not be so bad, except that during the fray of keeping a conversation going (I am the resident world-class ragchewer and must uphold that image) and inserting QTH in a logging program along with other pertinent and indispensable information, those clicks to the task bar get more frequent and very distracting.

Here is the best solution I have seen for that dilemma. Log Windows is engineered to work hand-in-hand with PKTerm or with the software by the same folks for one of the other controllers, and you will find it is only necessary to display the logging program while you are in contact. Why? The logging software also has a receiving pane and a composing area and you can do it all from the Log Windows panel once the contact is established. A genuine cure for my problem arrived at last.

While I was doing this evaluation, there came a message of an update for entry into the Log Windows from a pop-up in the Communications panel. With the version in front of me, it is necessary to highlight the other station's callsign and operator name and do a few calisthenics just to get this info into the macro and that still does not put it in the Log Window. This addition will be in the version you will download.

Endless features

Ah, but there is still more. Within this package is contained an excellent rig control that works. Log Windows has more goodies than you can shake a stick at. There is an up-to-the-minute listing of rigs that you can set up to control through your serial port and, in the process, automatically record mode and frequency in your log book. It works.

A little more? Yup, there is also a controller for your computer-controlled antenna rotator. The art of working DX has become a push-button performance with all the automation available these days. And you can get it all in one integrated package.

And perhaps your interests are just a bit broader. They also have a Wefax program to work with your controller. Pretty fancy stuff. As I was reading through the documentation on that, it was telling about automating to a point that it would record specific weather images at preset times and you don't need to be there; just simply have the equipment turned on. Beats watching TV for the weather pics.

Now, the credibility factor should be discussed. You may question just how slow-moving can your computer be and still run all this fancy stuff. I was discussing this with Rick W4PC, the developer, and he tells me of running the PKTerm on a 486DX/2 50 MHz

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Radio Direction Finding

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Secrets of the RDF Whirligig

America's Cup sailors always want faster boats. NASCAR drivers always want faster cars. Fighter pilots always want faster planes. Their goal is to win the race or the dogfight, and it takes the fastest and most "user-friendly" equipment to do that. The same is true in hidden transmitter hunting, which we hams call T-hunting or foxhunting.

Everyone knows that the fastest mobile T-hunting setups use Doppler units, right? Well, sometimes. On the plus side, a Doppler takes bearings hundreds of times every second and displays them instantly, even on very short signal bursts. VHF/UHF Doppler installations are inconspicuous, easy to use, have no moving parts, and interface readily with a computerized mapping and navigation system.

I use my mobile Doppler on two meter T-hunts when it's the right tool. But sometimes it isn't. A Doppler outputs a single bearing indication for each rotation of its array, no matter how many direct and reflected signal components are present. So in an area of high signal reflections (multipath), the display often bounces around aimlessly.

T-hunters here in southern California and elsewhere prefer rotating gain antennas such as beams and quads in these situations. Their receiver S-meter shows the azimuth of each incoming signal peak. That makes it easier to determine (or should I say guess?) which one is direct and which others are reflected. A beam setup is more sensitive than a Doppler, giving greater range. It works better on horizontally polarized signals, too.

Some T-hunters have taken the idea of separating the direct and reflected signals a step further by making polar plotters to show signal amplitude versus direction on a cathode-ray tube (CRT) or computer screen. The operator "eyeball averages" the fluctuations resulting from vehicle motion. A large repeatable lobe identifies the most likely direct bearing to the T. Reflections and noise in other directions show up as a jumble of noncorrelated traces after several rotations of the mast. If two or more keyed-down transmitters in different directions are on the frequency simultaneously (such as a jammer and the station being jammed), a polar display can resolve bearings for each of them. Try that with a Doppler!

One more plus for polar displays: The multiple overlaid sweeps on a CRT will give accurate bearings of single-sideband stations and pulsed noise sources. Dopplers, on the other hand, can't do this because they require carrier-type signals. They aren't designed to track emissions with large amplitude variations.

For good eyeball averaging, the CRT must display several rotations or sweeps of the RDF antenna at a time. An ordinary oscilloscope won't do. You need a storage-type oscilloscope or a high-persistence CRT like the ones in radar sets of the pre-computer era.

Notes from Nottingham

Last month, I began describing the polar plotting system used by Dave Bullock G6UWO and John Wood GØPSI. They have a motorized 5-element J-beam atop their sedan. A shaft encoder (**Photo A**) and digital logic generates beam azimuth data in sine and cosine form. When combined with S-meter values from the receiver, the CRT display shows incoming signal level in all directions simultaneously. As they drive the roads around Nottingham, England, Dave and John use the flickering lobes of the display to determine which is the most likely

Continued on page 44

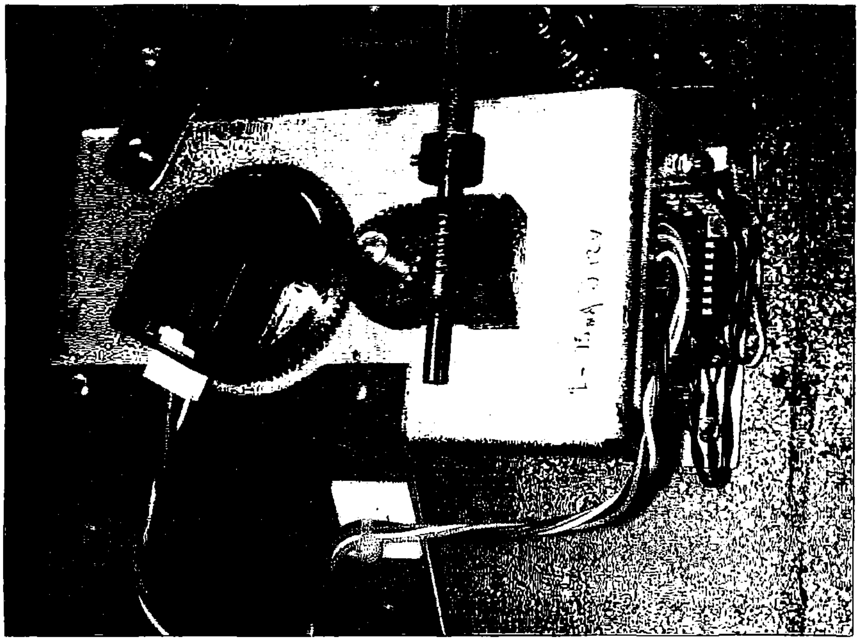

***Photo A.** The Hewlett-Packard shaft encoder and gearing system provides azimuth data. (Photo by Dave Bullock G6UWO)*

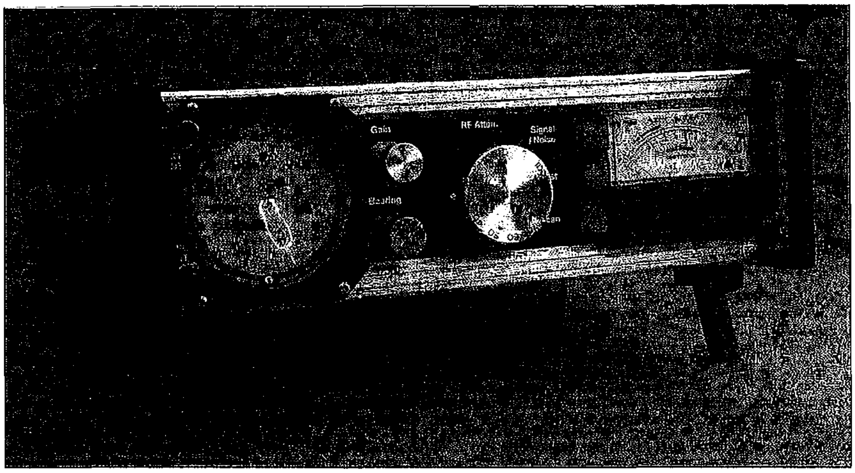

***Photo B.** Dave and John's final unit (for now) is in a recycled instrument case that fits easily on the dashboard. (Photo by Dave Bullock G6UWO)*

Homing In

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signal source direction and which other lobes represent multipath.

"Having hunted with the system for two full years now, I can report that it is almost unbeatable when pitched against both Dopplers and normal manually turned beams," Dave says proudly. The primary indication of signal strength comes from the S-meter output of G6UWO's Pye M2000 receiver. This set is unusual because its meter circuit output changes about one volt for each 20 dB change in signal strength. This gives the system a very wide dynamic range.

"We get a good indication of signal direction from a rock-crushing 6 feet away from the transmitter to an extremely weak signal in the noise," Dave continues. "We also developed a noise detection add-on that improves the sensitivity by a further 20 dB. The new circuit gives a full-scale indication with as little as 0.5 dB of quieting on the unsquelched FM background noise."

Figs. 2 and **3** in last month's "Homing In" are the schematic and board layout for the noise detector. G6UWO explains it this way: "Based on an 'absolute value' full wave rectifier, this circuit has perfect linearity and responds to the smallest of input voltages, making it ideal for detecting the slightest changes in quieting of the FM noise."

Dave's prototype polar plotter was a surplus video display unit with medium CRT persistence. He modified it by making his own X and Y deflection amplifiers from L165 ICs to drive the horizontal and vertical deflection coils, which he rewound with more turns of finer wire for greater screen deflection. He had to substitute a toroidal ring inductor for the horizontal coil in the high voltage DC-to-DC converter to keep it working properly.

The prototype proved the advantages of a polar RDF display, but Dave and John weren't satisfied. "It worked well," G6UWO wrote. "We successfully competed in our county championship for a whole season, winning by a narrow margin. But the display was too large. It had to sit on the floor between my feet and all the wires would get caught in my legs every time I jumped out to investigate possible hiding places.

"From a safety point of view, this was very unsatisfactory," he continued. "Operationally it was a nightmare! The large folding maps on my knee obscured the display and strong sunlight reflected off the screen. Also there was the problem of mentally transferring the angle of detected transmission from the display onto the map. Something had to be done to improve this situation. What we needed was a more compact, user-friendly setup.

"During the summer months, we scoured the radio rallies. John discovered a 2.5-inch-diameter radar display module from a Phantom fighter aircraft in one of the flea fair stalls. For fifty dollars, he snapped the bargain up and then worried if the tube would turn out to be faulty. Of course there were no circuit diagrams and most of the electronics was 'tropicalized' in a thick clear coating of a varnish-like material.

"I stripped the display to find that the power supply ran off 24 volts. It was a self-contained unit that would supply most of the potentials for the CRT. The only extras needed were negative grid bias and 9.7V for the tube heater. The heater was easy with a variable regulator. I used the high-voltage module recycled from an old fluorescent calculator display to give me up to –80 volts for the grid.

"The rest of the electronics was junk, apart from the deflection driver and output transistors that were on the end plate of the module. I decided to build my own deflection amplifiers incorporating these transistors, as I reasoned that they should be matched to the coils. I used a couple of operational amplifiers and tied the output

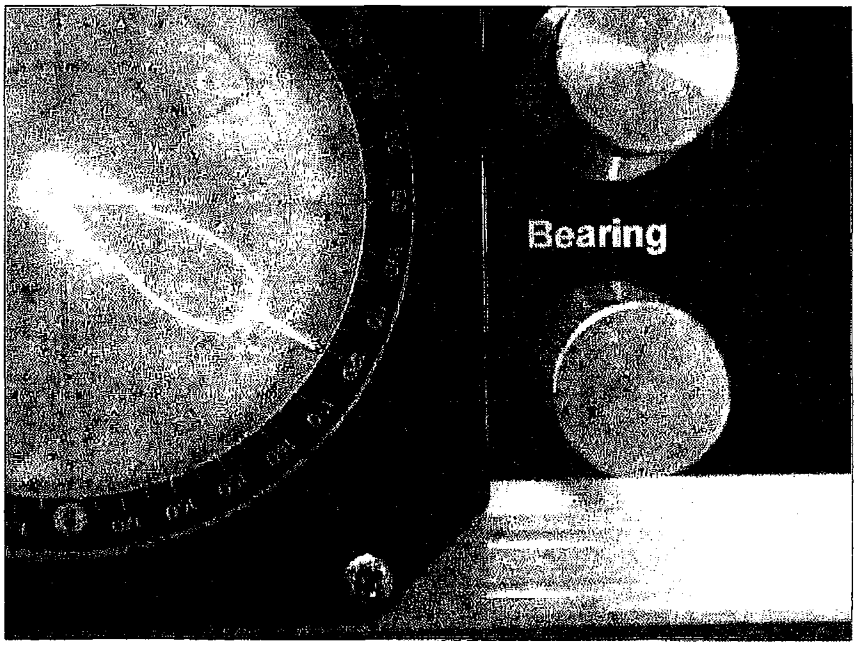

***Photo C.** Artificial persistence creates a trace with consistent intensity. The sharp point is a marker for precise plotting. (Photo by Dave Bullock G6UWO)*

transistors into the feedback loop to keep the whole circuit linear.

"I now had the problem of finding a 24-volt source. Our local military surplus depot came to the rescue. By modifying some ex-aircraft 400 Hz inverters that produced -32V from +32V, I was able to get the inverter to produce -12V from a +12V input. Now I had ±12V for my deflection amplifiers and 24V for the HV supply. The whole module could run off the car battery.

"The new scan amplifiers and coils worked extremely well, allowing me to move the trace around the screen at great speed without distortion. But that exposed my next problem. Being a white screen, the phosphor had a very short delay persistence, making the readout look like a tadpole swimming around, rather than a coherent polar plot!"

Constantly refreshing

Dave realized that he needed an "artificial persistence" circuit. He designed it using a dual-port RAM, which has independent input and output ports that point to the same memory locations. The memory is loaded with signal-strength data at the antenna rotation rate, but reads out to

Photo D. Transferring bearings from display to map is easy with this wand of light-emitting diodes. (Photo by Dave Bullock G6UWO)

the display at a much higher rate. It gives the appearance of a continuous display by refreshing at a rate that is faster than the persistence of vision.

"Whilst I was working on the redesign, I also had a stroke of luck with the antenna position encoder," Dave says. "At work I had a broken graphics plotter come into the

workshop as scrap. It contained some very nice optical shaft encoders made by Hewlett Packard that had 512 steps per revolution. This was an ideal opportunity to increase the resolution of the display from 208 steps to 512. I decided in the end, as everything else was 8 bit, to make it 256 points.

"I added a mechanical adjuster to turn the encoder with respect to the rotator system. With a signal source directly in front of the vehicle, the adjuster is rotated until the displayed lobe is drawn 'dead ahead' on the CRT. All misalignments in the system are removed in one go with this control, including any skew in the response of the antenna.

"As in the prototype, when the antenna turns, clock pulses from the shaft encoder drive an 8-bit counter that progresses through the RAM input addresses. The same clock pulses are fed to the 'start convert' pin of an A/D converter that digitizes the value of the S-meter voltage at that instant. An 8-bit number appears at the output of the converter, representing the magnitude of the signal at that position, and is stored in one of 256 RAM allocations.

"The antenna rotates continuously, storing data in the memory as it goes. At the 'dead ahead' position, a pulse from a second optical ring on the shaft encoder resets the address counter so that the antenna keeps in synchrony with the counter. I feared that under high-speed travel conditions and the high resolution of the encoder, extra pulses could be generated due to wind pressure on the antenna and slight backlash in the mechanics.

"The clock oscillator provides pulses that advance the output address counter. It steps through the output addresses of the Dual Port RAM and simultaneously, the EPROM address lines. The EPROM is loaded with sine and cosine waveforms, now regenerated with 256 points. The stored S-meter levels in memory are output to the D/A converter that restores them to a varying DC level. This, as before, controls gain of the sine and cosine D/A converters.

"As the clock oscillator runs, a circular timebase is created and signals are displayed on the CRT. The oscillator clocks the output system at a much higher rate than the input system is clocked by the antenna, so the display is that of a continuous plot being updated at the rotational speed of the antenna.

"All the aforementioned problems with wires and maps were eliminated by our miniaturization, and the controls were much easier to access, too. We didn't have any problems with jitter on the display due to slack in the mechanics, and the arbitration logic in the RAM invisibly takes care of any bus clashes."

Even with the high-tech CRT display, Dave and John put an S-meter on the console (**Photo B**). Based on experimentation with the system, they put marks on the meter to indicate approximate "miles downrange" for a transmitter of typical power output. The console also has a switch to select signal strength or noise mode, plus an RF attenuator in 10 dB steps from 0 to 100 dB. It goes between antenna and receiver to prevent overload.

"There is also an 'inch' control to zero the antenna dead ahead for high speed motoring between transmissions," Dave adds. "The Bearing control is another recent improvement. As can be seen on the display in **Photo** C, there is a sharp 'glitch' on the peak of the polar plot on the CRT. This is a pip marker that can be rotated 360 degrees around the display. The navigator moves it to select his best guess at the incoming direction. The pip data also goes via a ribbon cable to a clear-window wand that transfers this bearing to the map via a ring of LEDs (**Photo D**)."

Many thrills of victories

"The system has performed extremely well and we have been able to stay at the top of the Nottingham club's foxhunt championship for the last four seasons," proclaims G6UWO. "Dispensing with paper maps, we have adopted a GPS-based navigation system using a laptop computer. As an effort to make things work even better, we have modified the rotator to make it start and stop in two stages. The slow start should take some of the load off the mechanism as it gets up to speed. When I switch off, the rotator drops back to slow-mo and then autoparks dead ahead."

Does this inspire you to try a polar display in your own mobile T-hunting setup? Check your library for "Homing In" articles on five other such projects, as listed last month. Then decide what's best for your needs. Every system is unique and you probably won't want to copy any of them exactly, but a complete circuit description and schematics for the G6UWO/GØPSI version is available. Although there's no room to publish it all here, I'll mail a paper copy if you send me a self-addressed 9 x 12 manila envelope with postage for three ounces (77 cents in the USA).

Happy experimenting! Please send reports and photos of your successful polar

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Pocket APRS

APRS, the Automatic Position Reporting System invented by Bob Bruninga (WB4APR), is one of the really fun aspects of the hobby. With APRS you graphically display station locations on a map on a computer screen and track moving objects such as cars, satellites, balloons, etc.

While many APRS stations are composed of a desktop PC, a TNC (terminal node controller), and a 2-meter transceiver, much of the equipment has been getting smaller and smaller. There are now many mobile APRS operators, and some stations have become portable by utilizing handie-talkies and laptop computers. Radios such as the Kenwood THD-7A handie-talkie and the TMD-700A mobile rig have built in APRS capability including the TNC as well as an APRS program. Now, if we could only shrink the computer down to a more reasonable size, we'd be all set.

The good news is that we can now do just that. The popular personal digital assistants (PDA) that everyone is using to manage their schedules have given Mike Musick (NØQBF) the platform to develop a truly portable APRS display system. His system, called pocketAPRS, operates under the Palm OS, the operating system developed for the Palm Computing Palm PDA (formerly called the Palm Pilot). This operating system is also used for compatible PDAs such as the Handspring Visor. Mike's approach of using a PDA offers two major advantages. Obviously it makes APRS much more portable when one can carry his computer in his shirt pocket. The other major benefit is that a digital assistant is much cheaper than the cost of a dedicated computer (especially a notebook), so it lowers the overall cost of an APRS station. Naturally there are limitations, but none of any significance. The small size of a shirt-pocket-size system will limit the ability to display details, although one can zoom and scroll to view specific items. The Palm display is only 160 x 160 pixels and measures about two and a half inches square, so resolution is not what you'd see on a 17-inch SVGA monitor. There are also limitations in the pocketAPRS program caused by the basic design of the Palm and Palm OS. PDAs do not utilize hard drive storage or a multitude of inputs the way a desktop computer does, so the program is written for a memory-resident system. On the other hand, this does provide for more efficient operation while costing only 217K worth of memory. The system performance on the digital assistant ends up about the same as one would expect from a 386 computer, which is pretty impressive from a device about the same size as a calculator.

If you have a transceiver and a TNC, you can use your PDA with very little additional effort. Your PDA must be running Palm OS version 3.0 or later. Most of the units currently in use do just that, and upgrades are often available from the manufacturer as downloadable files. You'll need a cable that connects your PDA to your TNC and of course you'll need the pocketAPRS program. The cable has been available from several sources, although some that sold them in the past have gotten out of the cable business. The program is shareware and available for download at the Tucson Amateur Packet Radio (TAPR) FTP site: [ftp://ftp.tapr.org//aprssig/palmstuff/palmaprs/pctaprs.zip]. The current version is v1.14; this version fixes a series of bugs found in previous versions, so make sure that you have the latest update. For a lot of good information on this program, a trip to [http://www.pocketaprs.com] will prove to be time well spent. This site may also have current information or links available on vendors for the required cable. By the way, since this is shareware, good practice dictates that if you try this and like it you pay the $40 registration to Mike Musick. More important (sorry, Mike), the registration fee enables you to save settings between uses, which otherwise must be re-entered at every power up.

From a functional standpoint, pocketAPRS works just like any APRS system. The program is intense enough that using a PDA for APRS will disable almost all other functions until you exit the APRS program, but when I'm playing with my hobby, I don't want anything else to interfere. The APRS function also places a higher demand on batteries, but AAA cells are cheap, so this is something that is more of a "something to watch" than anything else. If you inadvertently run the batteries all the way down, most PDAs will lose whatever is in memory, which can be inconvenient (or worse.) Fortunately, the pocketAPRS program map display includes an on-screen battery monitor to help you keep tabs on battery life.

The PDA can display stations on a map in real time; send, receive, and track messages; and control the TNC. Many of the commands utilize a "one touch" philosophy utilizing the PDA's buttons. Help is readily available for most functions so learning (or remembering) a particular function is virtually painless. If you have a Kenwood TH-D7 or TM-D700A, this comes as close to "plug and play" as ham radio will allow.

Since APRS is graphical in nature, the basic format is to display station locations on a map. There is a fairly wide range of maps available for locations in the United States, and maps for other locations are beginning to become available. Currently, there are over 200 U.S. metropolitan areas available for download. Converting a map to this format requires an Apple Macintosh computer, so mapmakers are somewhat limited. The map detail is pretty impressive considering the size and memory limitations inherent in such a small package. By adding the map for Omaha and the US Interstate system, my total memory consumption

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New Products

Alinco Announces New North American Distributor

USA Alinco Branch has announced a major change in its distribution structure serving North America. Effective May 3, 2001, Alinco products will have been available to dealers and customer service obtained through Atoc Amateur Distributing of Ohio. The announcement was made by Katsumi "Naky" Nakata, manager of Alinco's North American operations, and Phillip A. Cota, president of Atoc Amateur Distributing.

"We are excited and pleased to announce this change," said Mr. Nakata. "Our new distributor has long and valuable experience in serving the dealer network and they have demonstrated a strong commitment to customer service with their product lines over many years."

Atoc Amateur Distributing will be headed by members of the Cota family, who also manufacture and distribute the Iron Horse and ATOC lines of antenna and radio accessories. The Iron Horse line also includes OEM and aftermarket accessories for large vehicles such as RVs, buses, and trucks. Phil's father, Glenn Cota, is also remembered as the creator and distributor of the Valor radio accessory product line, which the family sold to other interests several years ago.

Phillip A. Cota will lead the new distribution company. "We are proud to become the distributor for Alinco products in North America. Alinco has a well-established catalog of products and a reputation for strength, value, and reliability. Our mid-America location positions us well for attending to the needs of customers and dealers. It's going to be a very strong operation."

Mr. Nakata said that Alinco's corporate function would now concentrate on designing and manufacturing new products from its headquarters in Osaka, Japan. He emphasized that Alinco is a very committed, viable player in the Amateur Radio marketplace. It is also branching into related areas, such as the design and manufacture of high-quality scanning receivers available to the general public as well as to institutional users such as law enforcement and the military. "Having a distributor based in America is good for Alinco, good for the dealers, and most importantly, good for the growing Alinco customer base," he said.

The transition for dealers should be almost seamless, according to Mr. Nakata, as contacts and information will be handed over to the new entity. Evelyn Garrison, a long-time Alinco associate, will continue representing the Alinco line for the new organization. Importantly, all Alinco warranties will remain in force and continue to be honored through their term. In addition, customer support and out-of warranty service will be available through the new operation. Warranty customers should not be concerned, as warranties that expire in that period will be extended to cover the transition period. Details for shipping any radios in need of repair will be announced on the Web at [www.alinco.com]. "Radios already sent to our Torrance, California, address will be transferred to the new facility without fail," said Mr. Nakata.

Mr. Cota added, "We want to assure everyone that our customers will continue to enjoy exciting new products, excellent support, and the fine customer service expected from a quality operation."

Mini-News from CSS

• Creative Services Software has announced that version 3.07.33 of the popular logging program Log Windows has been released. This version supports Kenwood's new TS-2000 (including the Packet Cluster Tuning feature) and the new Yaesu FT-817 QRP rig, among many, many other features.

• CSS continues to work on 32-bit and 64-bit versions of Log Windows, with compatibility with the forthcoming Windows XP a priority.

• Autologging technology, allowing the user to log a contact directly from the TNC program without typing the data directly into the logging program, has been added to CSS's line of TNC programs, which include PacTerm '98, PKTerm '99, and MultiComm Host/Multimode (upcoming).

• CSS is discussing with Larry (Tree) Tyree N6TR the possibility of incorporating both TRLog and Log Windows technology into a next-generation contesting program.

For more information on these or other products, please contact Creative Services Software, 503 West State St., Suite 4, Muscle Shoals, AL 35661; tel. (256) 381-6100; fax (256) 381-6121.

SG-239 Smartuner Antenna Coupler

The SG-239 ushers in a renaissance of HF communications, as it will work with any transceiver to provide long distance communications across borders and continents. By using the SG-239 antenna coupler, anyone can achieve great results with a longwire antenna or a coaxial-fed multiresonant antenna at the window of a condo in a big city or on the roof of a small house.

The unit will work with silent receiver tuning or within the range of 1.5 to 200 watts with a high-power transceiver. It has 170 memory bins, with fast, accurate tuning via independent sensors, including VSWR, phase, magnitude, low impedance, and forward sensing.

For more information, contact SGC, 13737 SE 26th St., Bellevue WA 98005; tel. (425) 746-6310; fax (425) 746-6384.

Rockwell Collins Propagation Software

Rockwell Collins has upgraded its highly successful HF Propagation Resource Manager software to provide customers with the latest in communications technologies. Collins' PropMan 2000 identifies and displays the best channels for an HF communications link in a user-friendly graphical Windows/Windows NT environment. It dramatically improves communications quality and reliability, and is ideal for any HF radio operation.

Features include: real-time plot update to user-changed HF link parameters; ability to simplify complex HF propagation predictions; display of current frequency summaries and recommendations; tracks, analyzes, and stores HF propagation for multiple-user radio site pairs; and links degradation warnings.

Requires Windows 95/98/NT; VGA monitor, 640x480 at 256 colors; 20 Mb hard drive space; CD-ROM drive for install; Internet access; Internet Explorer 4.0 or greater. $99 plus s/h plus tax where applicable.

For further information, contact Rockwell Collins, PropMan Dept. 120-130, 400 Collins Road NE, Cedar Rapids, IA 52498; tel.: (800) 321-2223; fax (319) 295-4777; E-mail: [collins@collins.rockwell.com]; URL: [www.propman2000.com].

By Eric Shalkhausser W9CI, SK

The History of Ham Radio

Parts 7 and 8: Broadcast radio and the early '20s.

In the early 1920s, what effect did the emergence of radio broadcasting have on the amateur radio operator? Could it have been that he was directly responsible for the great popularity of this new entertainment field? Was amateur radio in some measure the instigator?

In 1919, Frank Conrad 8XK, one of our enthusiastic wireless amateur pioneers living in Pittsburgh, used his amateur station to entertain nearby listeners with musical renditions. He used an ordinary telephone mouthpiece as a microphone. This same station, with several modifications, went on the air as KDKA on November 2, 1920, known as the Westinghouse Pioneer Broadcaster.

Early broadcasting

History records that, as far back as 1910 and 1911, there were voice-modulated signals heard via wireless. These emanated from early experiments with the quenched arc-gap transmitters. Dr. Lee DeForest, the well-known inventor of the triode, had a voice-modulated vacuum tube circuit in operation in his laboratory in these early years.

With wireless broadcasting ushering in a complete new mode of living for millions, the old system of dots and dashes had to give ground to modulation of the ether waves by voice and music. Normal amateur communication now had company, as the general public suddenly took a fancy to this mysterious phenomenon. Such desirable services as weather and market reports, now via wireless, became an essential part of the daily menu for listeners — especially the farmers and the country folks. A new and exciting national pastime was ushered into being.

In the fall of 1920, station KDKA announced the first nationwide election returns of the Harding-Cox presidential contest. The immediate result of the over-the-air broadcast was hundreds of requests, directed to the Department of Commerce, for broadcasting station licenses. There could be no doubt that the entertainment factor suddenly stemming from dozens of stations would take over the airwaves. Experimenters, many companies, private organizations, and even individuals vied with each other to jump in and broadcast something, just to be heard.

Licensing

In the very beginning, the Commerce Department made available three general types of license permits. These were:

9XAF — experimental, designated by an X prefix;

9YAN — institutional and training school, a Y prefix; and

9ZHB — clubs and private organizations, a Z prefix.

The assigned frequency depended somewhat on the type of program the station intended to put on the air. The department issued such licenses for only three-month periods at a time. As the number of requests to broadcast mushroomed, all licenses to broadcast had more extended periods and were designated with either a W or a K prefix.

Amateur radio operators as broadcast listeners

There was no doubt that this newly discovered scientific wonder of broadcasting via radio had the amateur wireless operator deeply involved. He was found in the forefront of all the activity. With his innate knowledge of radio's mystery, he formed the nucleus

Reprinted from *73 Amateur Radio*, November 1978 and May 1979, where this was originally reprinted from *QCC News*, a publication of the Chicago Area Chapter of the QCWA.

of the listening public. He was in great demand to supply the information and, what then became necessary, the receiving devices, to the non-amateur public. There soon appeared the first one-tube "music box," equipped with a pair of earphones or just a single earpiece. Where distance from the transmitter was short, many early listeners used ordinary crystal detectors. The music box became an addition to the household, often replacing the phonograph and/or the piano for the evening's entertainment. Concerts, lectures, recitals, and news were there to enjoy as these events took place. Naturally, these sudden changes thrust upon an unsuspecting public brought about an almost revolutionarily altered standard of living.

Major problems in the overall radio field developed because of the wavelength allocations for hundreds of domestic stations that were clamoring for space in the ether spectrum.

Toward the end of 1921, the Department of Commerce was compelled to appoint a committee to try to devise a new code of on-the-air ethics. This was an attempt to correct a situation brought about by radio phone, something which could not have been foreseen in the original established laws of 1912.

Now two important matters came up for consideration: (1) regulating amateur broadcasting, and (2) solving interference problems between amateur transmissions, commercial broadcasting, and the novice listener.

In January 1922, Herbert Hoover, secretary of the Commerce Department, introduced proposed radio legislation requiring all transmitting stations used for broadcasting news, concerts, lectures, and similar programs to employ limited commercial license operators at the controls and to adjust wavelengths to 360 meters, with 485 meters to be used for issuing crop reports and weather forecasts.

Although the regulations issued by the Commerce Department were only temporary, they did cause concern among radio amateurs. They felt that some of their legitimate services were being curtailed, whereas the department always recognized the great national asset represented by amateur activities. With the phenomenal growth of broadcasting, however, it became necessary to regulate operations before the situation got completely out of hand. It was reasoned that, as long as the general public interest was being served, broadcasting had to continue, but not merely to satisfy someone's personal amusement desire. Coupled with miserable plate supplies, some stations severely cluttered up the airwaves. Under these conditions, the amateur 200 meter band became so overloaded that amateurs were finally asked by Secretary Hoover to collaborate and collectively come up with suggestions of their own for regulating the traffic in their own bailiwick. The understanding was clear to all. Between the telegraph and the phone, one necessarily must be subservient to the other. There was grave fear that the parting of the ways for amateur operation was imminent.

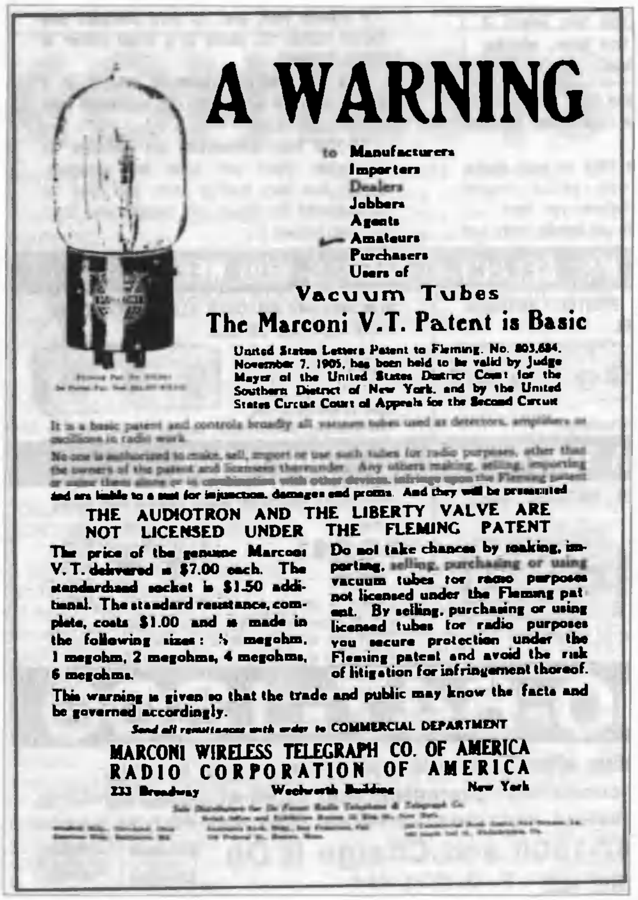

Photo A. Marconi patent advisory.

The first National Radio Conference

When the first National Radio conference was called in Washington from February 27 to March 2, 1922, there was common agreement among all concerned

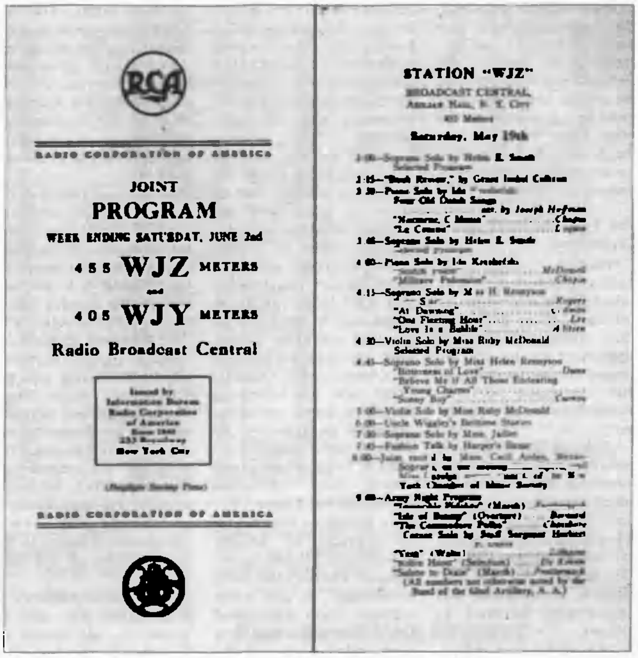

Photo B. RCA's WJZ and WJY broadcast schedule.

in the final report that was issued: no more phone broadcasts by amateurs.

Although this verdict set certain amateur stations somewhat aback, they did come away from the sessions with a recommended wave assignment extended to a range between 150 and 275 meters. At the conference, an amateur was henceforth defined as follows:

"An amateur is one who operates a radio station transmitting or receiving or both without pay or commercial gain, merely for personal interest or in connection with an organization of like interest."

Amateur phone vs. CW

How did all this change affect the amateur who had used the ether as his own domain for so many years? There was no way in which he could escape this "invasion" of his accustomed privacy. An unavoidable controversy soon developed among the CW and the phone hams. Without customary cooperation, it was recognized that the ether waves were loaded with interference of a new kind. How could the relation between the amateur phone operator and the dot and dash proponent avoid a serious break in the internal ranks, a situation that was evidenced in some *QST* correspondence between the older dyed-in-the-wool amateurs and the newcomers?

Added to this internal trouble of radio phone vs. code men, wireless had to come to grips with yet another problem, namely, citizen radio as distinguished from amateur radio. Would you believe that *QST* used its front cover page to designate its monthly magazine as follows: "devoted exclusively to *citizen* radio" (August 1922); and the following month it came up with: "devoted exclusively to *amateur* radio" (September 1922)? Typical amateur radio stood at the crossroads for a time.

To minimize chaotic interference, all phone broadcasts, those operating on virtually the same wavelength as the code stations, soon discovered that they were jamming each other unmercifully. What was pleasure turned into bedlam. All early courtesies of the ether waves, which had become recognized, were discarded and forgotten. To the technician who operated on phone, the code man was visualized as an ignorant brasspounder. Among the old-time CW amateurs, it was suggested that the phone man join a radio club or visit another station and observe what was going on among us "amateurs."

The need for order

By the fall of 1921, the radio telephone had heavy competition. There was the commercial broadcaster, the amateur broadcaster, the code man, and the many thousand helpless novice listeners. The various problems that developed were rapidly becoming more serious to amateur radio. Also apparent to everyone was the sudden upheaval in the transgression of existing legislation to control transmitters. For a number of years, as no consideration had been given toward initiating revisions in the old 1912 law.

At the conclusion of the conference, all amateurs were informed that, effective

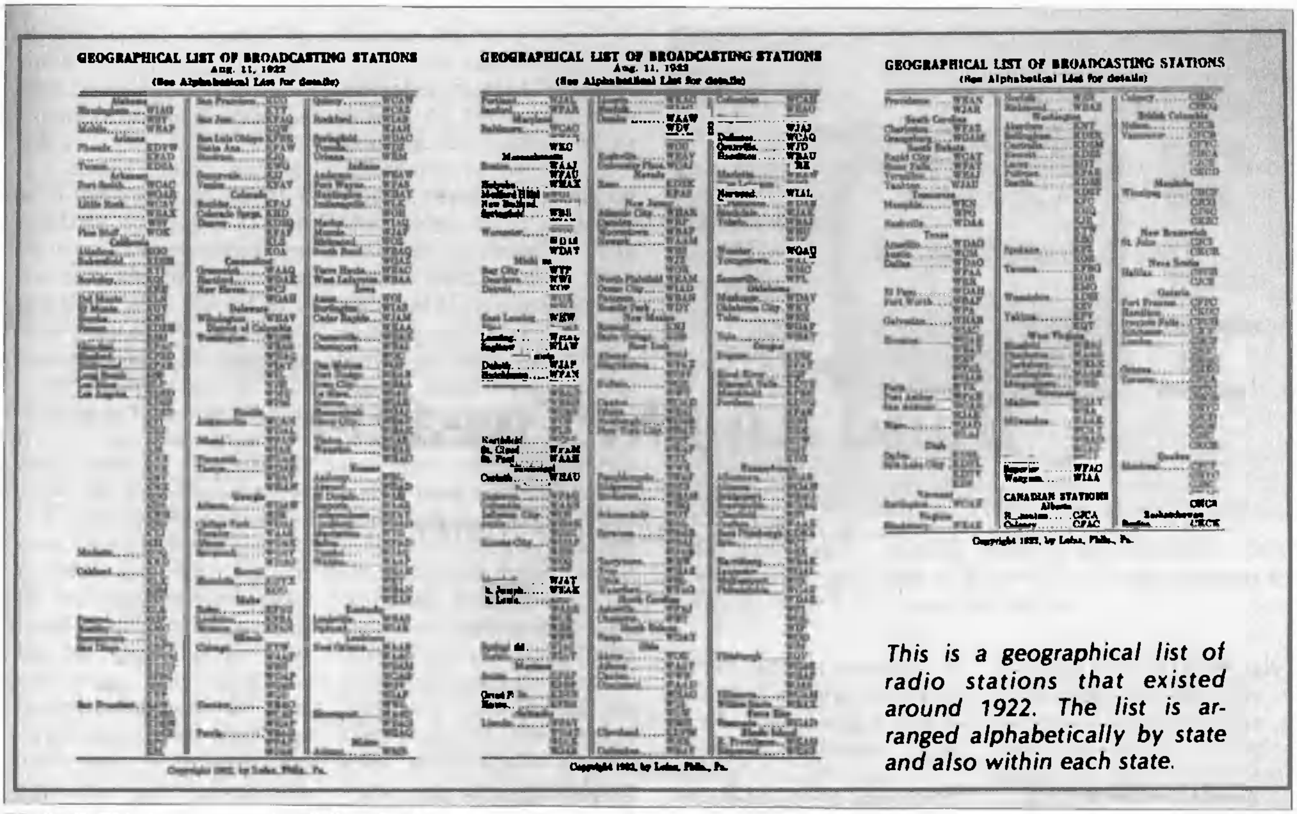

Photo C. This is a geographical list of radio stations that existed around 1922. The list is arranged alphabetically by state and also within each state.

immediately, a silent period must be observed from 8:00 to 10:30 p.m. daily and during Sunday morning church services. The first National Radio Conference placed commercial broadcasting into the 310 to 435 meter range. The amateur was not only assured his existence, but also came out ahead in the assigned waveband territory in which he could operate. He was asked to so divide his newly designated territory to the satisfaction of all concerned.

The radio conference in Washington was well attended by all parties affected and served to allay a number of conflicts. The regulations proposed were only recommendations to be observed among many interests. All realized that this was no binding law, although it was a hope that all would cooperate. In an attempt to approve wavelengths, however, the allocations came to naught, because the military interests still dominated the deliberations and a tentative international agreement drawn up was promptly repudiated.

Proliferation of broadcasting stations

By April 1922, there were 60 large and powerful broadcasting stations operating on the air, with approximately 500 applications for broadcast licenses pending. Such proliferation of signals emanating from so many stations in the assigned operating spectra, with no binding assigned frequencies, proved chaotic. More hearings were scheduled by the secretary, but, since recommendations did not carry legality, there could be no enforcement, so agreements were not respected.

The amateurs at the conference heard plenty of discussions about giving up spark transmitters altogether in order to alleviate interference. CW had come into its own in many stations. Just one paramount drawback, however, slowed the changeovers. The cost of the higher-power tubes for conversion necessary to compete with the power output of the spark was still a factor. New power supplies required a new approach to deliver a signal. Such costs put a decided crimp into the ham's pocketbook. The time was not ripe for abolishing one system for the other, as much as this was desirable. Patent litigations among the larger companies and corporations hindered many developments in equipment and accessory components, especially in the vacuum tube area, where competition for manufacturing rights was especially keen.

By now, there were approximately 14,000 licensed amateurs in the United States. The American Radio Relay League made a request at one of the regional conventions to lend a helping hand to the many broadcast listeners, who, like the farmer, his family, the grocer, and the banker, had no knowledge of adjusting even the simplest receiver. The receivers available on the limited market in many instances were still so primitive and crudely constructed that selectivity was impossible to attain, making elimination of interference out of the question. The uppermost need for simple workable receivers was at hand. Something practical to place into the hands of the folks who would become the vast audience to monitor and judge the future broadcasting programs on the air beckoned.

* * *

The evolution of radio before, and to a great extent during, the 1918 war year was for the most part in the hands of radio amateurs and the experimenters. The development of the vacuum tube and its utilization required much time for laboratory research. The quenched-gap and crystal detector were still very much in use. Considerable effort was being put forth by commercial companies together with government engineers, notably the Navy, to develop reliable means of generating undamped waves along semi-mechanical electrical lines.

The culmination of these efforts was the Alexanderson alternator, providing high frequency energy with power up to 200 kilowatts to satisfy navigational and overseas communication demands.

Following the evolution of radio art, two major patent-issuing corporations emerged in America, undertaking research toward larger and better vacuum tubes to replace the quenched-gap and the alternator. They were Radio Corporation of America, a group consisting of General Electric Company,

Photo D. Armstrong's Super-Regenerative Receiving Set.

Westinghouse Electric and Manufacturing Company, and American Telephone and Telegraph Company, which pooled patent licenses, and then Hazeltine Corporation, an independent licensing holder. This was a time when many patent applications were flooding the patent office covering circuit designs, and many component parts were entering into the assembly of radio receivers and transmitters. The two companies acted initially as holders of patent rights and issued licenses. Many individuals and small organizations, doing private research, were filing patent applications on hundreds of ideas pertaining to radio, thus leaving the budding industry wide open to massive confusion. The license holders tried to meet this avalanche of new developments by issuing warnings to developers, inventors, and all those who were active in the field, including those who purchased radio parts from dealers and jobbers. The warnings read, "The assembly of a receiver is only for your own private, experimental use, which includes broadcast reception of music and entertainment, not for broadcast transmission and NOT FOR SALE." In other words, licenses had to be obtained first by dealers or jobbers, manufacturers, or assemblers to go into business. With such regulations, back-door trading became commonplace, and many instruments found outlets designed to circumvent the restrictions.

It was to be expected that to satisfy the demand of the listening public, there would be concerns engaged in building and assembling receivers. During this period, it was not possible to standardize any specific design because of the extremely high rate of turnovers and obsolescence. The radio amateur was busily building and assembling sets for his friends and neighbors, who reaped the benefits of his expertise in wireless.

The market mushroomed with the proliferation of broadcast transmitters throughout the United States and the rapidly increasing availability of radio receivers. Improvements in quality and reliability also contributed to lowered costs. Vacuum tubes were produced by the thousands, gradually improving their function but remaining far from being a uniform product. The UV-200 detector and the UV-201 amplifier were the mainstays. All others were either experimental or leftovers from previous designs.

The year 1921 saw a rapid growth of broadcast radio service. Electric manufacturing companies, universities, newspapers, and many individuals obtained permission from the Department of Commerce to become broadcasters. Radio amateurs had permission to transmit news, music, and items of interest over their stations. Broadcasting received the attention and guidance of various government departments. Interest in radio was universal.

This rapid expansion also had its reverse effects. Interest waned when disturbances occurred. The reason —general news and entertaining music was relegated to one wave-length, i.e., 360 meters. Official government stations broadcasting information, weather, and market news were on a wavelength of 485 meters. Not all stations held to these wave assignments accurately. Deviations gave some stations advantages over others. There was not

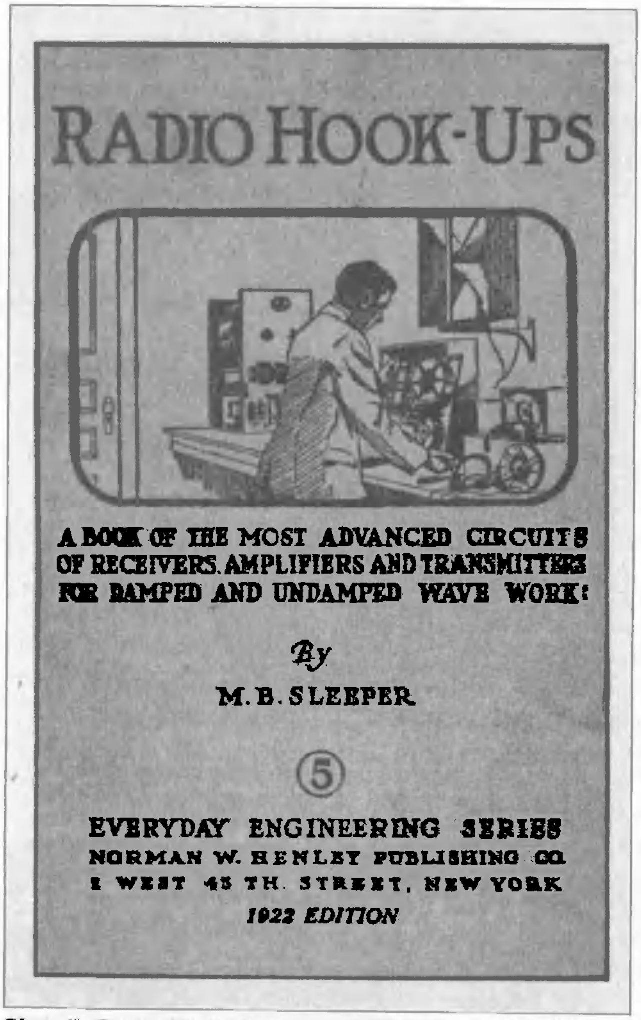

Photo E. Cover of Radio Hook-Ups, *1922 Edition, by M.B. Sleeper*

enough room for all to communicate without excessive crossovers. The 1921-1922 receivers were not built to be selective or to avoid overlapping signals. Unless stations geographically close together decided by agreement to broadcast at different times of the day or were located some distances apart, the listener was denied satisfactory reception.

This troublesome problem of interference became so acute that in February, 1922, the Department of Commerce drew up plans which rearranged wavelengths to the broadcaster and to other services as follows:

Public Broadcasting, signifying broadcasting from universities, public institutions, and stations licensed for the purpose of dissemination of information and for educational services, was assigned 485 to 495 meters.

Private Broadcasting, signifying broadcasting by a newspaper, private or public organization, or person licensed for that purpose, including amateurs, was assigned 100 to 150 meters and 285 to 485 meters.

Other wavelengths were intended for commercial ship to shore and overseas communication.

General broadcasting stations were on wavelengths sufficiently different so as not to be heard when a receiving set was tuned to another station. This was to be determined by the broadcaster himself, using his own equipment. Amateurs were supposed to operate mostly late at night, using wavelengths below 275 meters. The early receivers had practically no selectivity. They were very broad tuning, unstable, and consumed a great deal of energy, operating from dry cells and storage batteries. Radio receivers which could be operated from the standard 115-volt circuit had not yet arrived.

In 1914, Major Edwin H. Armstrong invented a radio receiver circuit known as the regenerative circuit. He obtained a patent from the government on October 6, 1914. This circuit described the use of the vacuum tube in a detector-oscillator combination. Vacuum tubes were at that time only in the experimental stage, crudely constructed, unreliable, and not readily available. Consequently, very little development took place before 1917 to test the unique application of the Armstrong circuit wireless signal reception.

The regenerative principle in the circuit is most simply described by stating that when energy is applied at the input terminals of a circuit connected to a vacuum tube in oscillation, the circuit presents either a more negative or a more positive reaction. The objectionable feature of a regenerative circuit was self-oscillation, which was uncontrollable in the hands of the average user. The whistles and howls coming from the loudspeaker or headphones were shocking and became unbearable.

Under such unstable conditions, the radio amateur came up with novel innovations, especially when tuning to continuous wave signals. When using his audiotron tube or his Marconi, De Forest, Donle, or Connecticut "vacuum bottle" for that critical adjustment to bring the reception under control, the presence of a magnet in the proper vicinity of the tube, held at certain angles to the bulb, would increase the intensity of the signal. Close adjustment of the magnet gave excellent results.

Early in August, 1919, the De Forest Company announced one of the first receivers for the monitoring of phone and/or continuous wave signals. It covered 160 to 450 meters and was designated the three-coil ultra-audion. It was designed as a short-wave regenerative

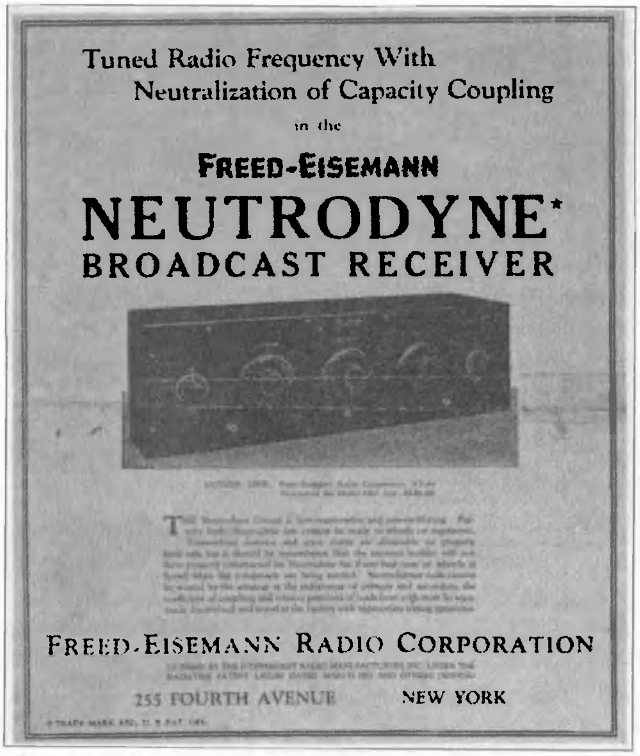

Photo F. Well-known in 1922, the neutrodyne receiver was designed around a non-regenerative and non-oscillating configuration. This circuit did not emit objectionable whistles when properly constructed and assembled.

instrument composed of a series of individually-wired sections and was hooked up as a composite assembly. Hardly a receiver for use by the general public.

Receivers could be assembled following the circuits illustrated in handbooks like the one issued by M. B. Sleeper entitled *Radio Hook-Ups.* The illustrations basically used a coil or two, a tuning condenser, and either a crystal or vacuum tube detector plus a pair of headphones. The tubes available were leftovers, designed during the war by French, German, English, and American laboratories.

They were not very reliable and rarely gave uniform results. It was not uncommon to find a back-room laboratory coming up with some exotic tube design. The intent was to try to improve such undesirable characteristics as excessive filament current drain, objectionable interelectrode capacitances, and short-lived filament emission.

Photo G. In August, 1919, the De forest company announced one of the first receivers for monitoring phone and/or CW signals.

The radio literature of the 1920s carried instructions on how to assemble receivers utilizing various types of coils (these included universal, honeycomb, unilateral, duo-lattice, bi- and multi-lattice), tuning condensers (of the straight line wave-length, straight line frequency, book-type design), variometers, and variocouplers tied to a vacuum tube or two in cascade.

In 1920, the radio amateur and the avid listener had available receivers manufactured under license. They were known as Grebe CR instruments. These receivers were not the type to place into the hands of the uninitiated. They were meant for the radio amateur and experimenter.

For short-wave reception, which included broadcast, the internal capacity of the tube proved a bar to any straightforward solution. Realizing that the vacuum tube was at the heart of the problem, Major Armstrong came up with a solution in the circuit principle named the heterodyne and super-heterodyne. It is based on the mixing together of two frequencies in order to produce two frequencies which are equal to the sum and difference of the other two. In so doing, an intermediate frequency was produced which could be more effective and responsive to the characteristics of the available tube. The resultant amplification was a comparison of the voltage applied to a second detector in the circuit to that of the incoming terminal voltage.

A receiver built along these lines required a series of 6 to 8 tubes and gave excellent amplification. It required skilled manipulation of the controls, since adjustments had to be made at numerous positions to track the frequencies of the incoming signal. Sensitiveness of the superheterodyne receiver was proven by Paul Godley while at Androsen, Scotland, in December, 1920, when he logged numerous American stations during the transatlantic initial DX contest, related in part 5 of "The History of Ham Radio."

In analyzing the various circuit combinations of the heterodyne, it was found that the operation of the system proved a little too critical, especially since, to avoid interaction, individual tubes were required for detection and for rectification. As a result, tuning became more complicated. Engineers

remarked that if some way could be found for tuning adjustments to be set and sealed in the laboratory by skilled engineers leaving relatively simple adjustments to the operator, the receiver would be the ideal.

The main difficulty which had to be overcome was the instability from the combination of high amplifications desired. The solution hinged on overcoming the generated oscillations when the number of tubes of the 1921–1922 vintage were hooked to one another in cascade. Much effort was expended in designing intertube transformers of air-core, special iron-core, special couplings, and windings, to balance the impedances from stage to stage. Instability was the problem, again depending on the tubes available.

Well known, in 1922, was a receiver called the neutrodyne. It was designed around a non-regenerative and non-oscillating configuration. When properly constructed and assembled, the one thing this circuit did not do was emit objectionable whistles. The neutrodyne relied on straightforward cascade amplification of the incoming signal. It started with one or two stages of radio frequency amplification, then detection and reinforcement with one, two, or even three stages of audio frequency amplification. It was a popular receiver in its day. The set suffered from an undue amount of internal noise, generated and amplified due to mis-matched component parts, internal tube disturbances, and lack of sufficient tuning controls to balance out the inherent design faults.

About this time in the era of wireless evolution, the amateur's thoughts were directed toward mobile and portable gear. 73

QRP Asylum Update

continued from page 26

Wes Hayward W7ZOI and Jeff Damm WA7MLH, Technical Correspondence, *QST*, November, 1989. Discussion on MOSFET power amplifiers.

Minnesota QRP Club [http://www.qsl.net/mnqrp/].

Norcal QRP Club [http://www.fix.net/~jparker/norcal.html].

Radio City, 2663 County Road I, Mounds View, MN 55112. 1-800-426-2891. [www.radioinc.com].

Radio Shack, [www.radioshack.com].

Radio Society of Great Britain, [http://www.rsgb.org].

Ramsey Electronics, 793 Canning Parkway, Victor, NY 14564. (716) 924-4560. [http://www.ramseyelectronics.com]

73 Amateur Radio Today Magazine, 70 Hancock Road, Peterborough, NH 03458-1107.

Solid State Design for the Radio Amateur, Wes Hayward and Doug DeMaw, ARRL, 3rd Printing, 1995. ISBN 087259-040-2.

Technical Topics Scrapbook, 1990-1994, Pat Hawker G3VA, Radio Society of Great Britain, 1999. ISBN 1-872309-51-8.

Technical Topics Scrapbook, 1995-1999, Pat Hawker G3VA, Radio Society of Great Britain, 2000. ISBN 1-872309-61-5.

W1FB's Design Notebook, ARRL, 1st Ed., 2nd Printing, 1994. ISBN: 087259-320-7.

W1FB's QRP Notebook, Doug DeMaw, ARRL, Second Edition, 1991. ISBN: 087259-034-8. 73

Your Long-Lost Transistor Notebook

continued from page 30

Working with transistors is a lot of fun when you understand how they are going to react to a stimulus. During the course of our tour you will gain the understanding and insight to design and analyze a circuit using "tools" developed during the tour.

Sort out your transistors and begin collecting data on each type. Part 2 in your "Notebook" will begin with plotting the data that you've recorded using the data format shown in **Table 1**. 73

Read All About It!

continued from page 35

(another Mark I) in February of 1951, three months before the UNIVAC.

So, who built the first digital computer? I guess it's not so simple a question as, "Who invented the light bulb?"

What's in a name?

• Pick any field of study you like, and chances are the ancient Greeks originated it. The word for our technology, electronics, comes from the Greek elektra, meaning amber. Amber is the dark translucent yellow substance obtained when tree sap hardens — an early plastic, if you will. When amber was rubbed with lamb's wool, the Greeks noticed the clinging phenomenon familiar to any modern who has ever taken a piece of nylon clothing out of a dryer. Ben Franklin and others picked up this investigation of electrostatics 2,000 years later, with results known to us all.

The words electric and electron were widely used in the first decades of the twentieth century, but the word electronics, implying applications of the vacuum tube beyond the original radio area, did not gain currency until a magazine bearing that name appeared in 1930.

• Lee De Forest, inventor of the triode vacuum tube, called his invention the audion — a contraction of audio and ion. He remained convinced that its operation depended on ionized gas inside the bulb long after nearly everyone else had recognized the need for a near-perfect vacuum. DeForest also used the term "wing" for the element which everyone now calls the plate. Of course, Ambrose Fleming, who invented the vacuum diode, called it a valve, and the British continue to say "valve" where we would say "tube" — such are national loyalties.

• The word transistor was coined as a contraction of transfer resistor. Transfer is an engineering term implying a relationship between an electrical output quantity and an input voltage or current. The idea was that an input current would control an output resistance. The term is not a good one, because the transistor's output characteristics are not at all like those of a resistor. Doubling the collector voltage does not double the collector current, for example: it hardly changes collector current at all.

• We call a three-terminal variable resistor a potentiometer because an early version of this device was used

in a potential-measuring circuit. A known voltage was voltage-divided down to exactly balance the unknown voltage, as indicated by zero reading on a galvanometer. Today, of course, a "pot" is but seldom used in a potentiometer circuit.

• No naming question generates so much heat on Internet newsgroups as the BNC connector. Some say it means British Naval Connector, while others insist it stands for Baby N-series Connector. One authoritative-sounding post said it simply recognizes the style and designers: Bayonet Neill Concelman.

• There is less controversy over the XLR mic connector. X is simply the manufacturer's series, L denotes a newer Locking version that won't fall out, and R is for the Rubber inset for the pins, replacing the hard plastic, which resulted in pin damage.

• National Radio's famous top-of-the-line receivers, beginning in the '30s and culminating in the '60s, were named the HRO series. An old-timer at the company related that the original production run was done under pressure approaching panic — it was a Hell of a Rush Order. I can believe such flippancy, because when I worked for an elevator company the prototype for a certain controller was built on a wooden frame. Someone had scribbled the size of a saw cut on one of the boards: 4 x 5 inches. It became known throughout the industry as the 4XS controller.

Calendar Events

continued from page 37

Amateur Radio Assn., Inc., P.O. Box 528, Englewood NJ 07631-0528 USA. A #10 size SASE should be included for results. (8) Stations planning active participation in New Jersey are requested to advise EARA by August 1st of your intentions so that plans can be made for full coverage from all counties. Portable and mobile operation is encouraged.

Hamsats

continued from page 39

During the early "NOCALL" packet days I used a Kenwood TD-D7 HT with an antique hand-held Poqet PC to successfully send numerous unconnected packets through the ARISS TNC. I did have the advantage of a 14-element circularly-polarized crossed yagi, though. For the packet configuration I only needed to set a few items in the HT's internal TNC. I set MYCALL W5ACM-2 and UNPROTO EL29EQ VIA NOCALL, ANDY,STEX. I then went to CONVERS mode and started transmitting on the packet uplink when the space station was over my horizon. The unique UNPROTO setting allowed my unconnected packets to be digipeated via NOCALL, and when they did, other Earth stations would see my grid locator EL29EQ, along with my name and general location in Texas. The NOCALL problem won't be around long, but it was good fun to communicate via NOCALL in space while it lasted.

Even with their extremely busy schedules on the space station, the astronauts seem to find more time for ham activities the longer they are in orbit. Plot some orbits, or at least set up a scanner to monitor 145.80 MHz. MIR lasted 15 years, and Space Station Alpha's operations have only begun. In the near term we will have voice, packet and multimode SSTV on 2 meters and 70 cm. Later activities will include more modes and even HF operation.

The Digital Port

continued from page 42

laptop. I have programs that won't even open on my 120 MHz laptop.

However, he did qualify the PSK31 module as needing a Pentium 90 or better. Well, most of the computers with the needed soundcard have at least a low end Pentium. Rick added that the LogWindows program would run on a 386 with Windows 3.1 and subsequent faster machines with Windows versions to the present.

One of the secrets of this success story is the use of (an effort) C and C++ programming. There are some very nice working programs written in Visual Basic, but many of these will slow down, perform poorly and crash often when put in the slower hardware environment. There is a difference.

So you should be able to assemble a genuine whiz-bang, high-duty, do-everything computer coordinated station with the least outlay, especially in the computer department. A little software will do for most of your needs, and possibly a soundcard and a little additional cabling can do wonders.

There are a lot of things happening on the digital front in ham radio. This is only one of the interesting happenings. I see several more developments coming up that will make good fodder for the next few months. I don't see a slowdown in the creative imaginations of those who are keeping this digital revolution going.

That will have to do for this month. If you have questions or comments about this column, E-mail me [jheller@sierra.net]. I will gladly share what I know or find a resource for you. For now, 73, Jack KB7NO.

Homing In

continued from page 46

display installations. E-mail and postal mail addresses are at the beginning of this article, as is the URL for the "Homing In" Web site. There you'll find lots of information about transmitter tracking in the USA, plus a link to the Amateur Radio Club of Nottingham site for more news of radio foxhunting in England.

On the Go

continued from page 47

is only 738K, but I don't think I'd want to have a large collection of maps loaded at all times.

With more public service and weather communications occurring via APRS, the ability to set up a station quickly and easily or even carry one with you enhances our ability to be a communications resource. This program moves APRS to its next logical level. This definitely is another fun aspect to the hobby that has some real practical implications as well. If you are into APRS, or have been tempted to try it, pocketAPRS will be well worth your time.

QRX

continued from page 6

E5A Characteristics of resonant circuits: Series resonance (capacitor and inductor to resonate at a specific frequency); parallel resonance (capacitor and inductor to resonate at a specific frequency); half-power bandwidth.

E5B Exponential charge/discharge curves (time constants): definition; time constants in RL and RC circuits.

E5C Impedance diagrams: Basic principles of Smith charts; impedance of RLC networks at specified frequencies; PC-based impedance analysis (including Smith Charts).

E5D Phase angle between voltage and current; impedances and phase angles of series and parallel circuits; algebraic operations using complex numbers: rectangular coordinates (real and imaginary parts); polar coordinates (magnitude and angle).

E5E Skin effect; electrostatic and electromagnetic fields.

E5F Circuit Q; reactive power; power factor.

E5G Effective radiated power; system gains and losses.

E5H Replacement of voltage source and resistive voltage divider with equivalent voltage source and one resistor (Thevenin's Theorem).

E5I Photoconductive principles and effects.

Subelement E6 — Circuit Components
[5 Exam Questions — 5 Groups]

E6A Semiconductor material: Germanium, Silicon, P-type, N-type; Transistor types: NPN, PNP, junction, unijunction, power; field-effect transistors (FETs): enhancement mode; depletion mode; MOS; CMOS; N-channel; P-channel.

E6B Diodes: zener, tunnel, varactor, hot-carrier, junction, point contact, PIN and light emitting; operational amplifiers (inverting amplifiers, noninverting amplifiers, voltage gain, frequency response, FET amplifier circuits, single-stage amplifier applications); phase-locked loops.

E6C TTL digital integrated circuits; CMOS digital integrated circuits; gates.

E6D Vidicon and cathode-ray tube devices; charge-coupled devices (CCDs); liquid crystal displays (LCDs); toroids: permeability, core material, selecting, winding.

E6E Quartz crystal (frequency determining properties as used in oscillators and filters); monolithic amplifiers (MMICs).

Subelement E7 — Practical Circuits
[7 Exam Questions — 7 Groups]

E7A Digital logic circuits: Flip-flops; astable and monostable multivibrators; gates (AND, NAND, OR, NOR); positive and negative logic.

E7B Amplifier circuits: Class A, Class AB, Class B, Class C, amplifier operating efficiency (i.e., DC input versus PEP), transmitter final amplifiers; amplifier circuits: tube, bipolar transistor, FET.

E7C Impedance-matching networks: Pi, L, Pi-L; filter circuits: constant K, M-derived, band-stop, notch, crystal lattice, pi-section, T-section, L-section, Butterworth, Chebyshev, elliptical; filter applications [audio, IF, digital signal processing (DSP)].

E7D Oscillators: types, applications, stability; voltage-regulator circuits: discrete, integrated and switched mode.

E7E Modulators: reactance, phase, balanced; detectors; mixer stages; frequency synthesizers.

E7F Digital frequency divider circuits; frequency marker generators; frequency counters.

E7G Active audio filters: characteristics; basic circuit design; preselector applications.

Subelement E8 — Signals and Emissions
[4 Exam Questions — 4 Groups]

E8A AC waveforms: sine wave, square wave, sawtooth wave; AC measurements: peak, peak-to-peak and root-mean-square (RMS) value, peak-envelope-power (PEP) relative to average.

E8B FCC emission designators versus emission types; modulation symbols and transmission characteristics; modulation methods; modulation index; deviation ratio; pulse modulation: width; position.

E8C Digital signals, including CW; digital signal information rate vs bandwidth; spread-spectrum communications.

E8D Peak amplitude (positive and negative); peak-to-peak values: measurements; Electromagnetic radiation; wave polarization; signal-to-noise (S/N) ratio.

Subelement E9 — Antennas And Feed Lines
[5 exam questions — 5 Groups]

E9A Isotropic radiators: definition; used as a standard for comparison; radiation pattern; basic antenna parameters: radiation resistance and reactance (including wire dipole, folded dipole), gain, beamwidth, efficiency.

E9B Free-space antenna patterns: E and H plane patterns (i.e., azimuth and elevation in free-space); gain as a function of pattern; antenna design (computer modeling of antennas).

E9C Phased vertical antennas; radiation patterns; beverage antennas; rhombic antennas: resonant; nonresonant; radiation pattern; antenna patterns: elevation above real ground, ground effects as related to polarization, take-off angles as a function of height above ground.

E9D Space and satellite communications antennas: gain; beamwidth; tracking; losses in real antennas and matching: resistivity losses, losses in resonating elements [loading coils, matching networks, etc. (i.e., mobile, trap)]; SWR bandwidth; efficiency.

E9E Matching antennas to feedlines; characteristics of open and shorted feedlines: 1/8 wavelength; 1/4 wavelength; 3/8 wavelength; 1/2 wavelength; 1/4 wavelength matching transformers; feedlines: coax versus open-wire; velocity factor; electrical length; transformation characteristics of line terminated in impedance not equal to characteristic impedance; use of antenna analyzers.

FISTS Fighting

Don't look now, but Morse advocates are far from giving up on the code, and their organized advocacy continues to grow. For example: FISTS is the worldwide group dedicated to the preservation and use of code in the amateur radio bands. It now has member services that include a regular newsletter called *Keynote* and a QSL bureau for the exchange of cards between FISTS members — who now number almost 5,000.

Thanks to Q-News, *via* Newsline, *Bill Pasternak WA6ITF, editor.*

Gumming in

Now comes this bit of news from across the Pacific, where a Japanese dentist recently invented a way to implant a microchip locator into false teeth. The microprocessor can be detected with a radio transceiver, enabling the denture wearer to be gummed ... er ... homed in on and identified.

Why do this, you ask? Well, it seems that some medical facilities such as senior citizens' homes collect dentures from their owners after each meal. They then wash all of them together. The inventor says that his micro implant would ensure that the correct set of dentures goes back to the rightful owner.

Now that's a plan with some teeth in it!

Thanks to Q-News, *via* Newsline, *Bill Pasternak WA6ITF, editor.*

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The Doldrums

Signal absorption during the day and atmospheric static at night are the hallmarks of July, placing it at the heart of the "summer doldrums" — a very challenging period for DXers. Expect intense noontime ionization to weaken signals on 10 through 20 meters, and heavy atmospheric static to limit nighttime activity on 30 meters and above. Although early mornings, late afternoons, and evenings will provide workable HF on at least half the days this month, plan on consoling yourself with other activities occasionally.

Despite this less than enthusiastic outlook, and what you may have inferred from my calendar, there is reason for a little cautious optimism: We are in a peak month in a peak year of Solar Cycle 23. In other words, "Thar's gold in them thar hills" — but it will take some effort and a little luck to uncover.

By definition, a peak in the solar cycle means that we have a large average daily number of sunspots, and these are closely related to increased levels of ultraviolet radiation. As all licensed radio operators should remember, ultraviolet radiation causes the gases in our upper atmosphere to become ionized, forming the HF-reflective ionosphere. As a rule, greater ionization means greater reflectivity and better propagation.

Another benefit of a strong ionosphere is its increased resistance to disruption. When ionization is high, only the larger solar events will appreciably effect radio propagation. My point is, there is almost always something workable during solar maximum no matter how bad things are, and if the bands do go totally haywire, they usually recover quickly. A vivid demonstration of this occurred in mid-April, when the Earth passed through the intense particle stream of an X14 flare, the second largest recorded in a decade. Although there was an abrupt worldwide HF blackout, communications were back to "normal" within 12 hours. If the ionosphere had been weak at the time the blackout might have lasted for several days.

Admittedly, there is a drawback to having a really strong ionosphere, and that is the problem of noontime signal absorption as the Sun passes through its zenith each day. While this is a moderate annual phenomenon, the problem is greatly exacerbated every eleven years or so when sunspot activity reaches a maximum. Fortunately, there is a positive aspect to this and that is where the

July 2001						
SUN	MON	TUE	WED	THU	FRI	SAT
1 F-P	2 F	3 F-G	4 F-G	5 F-P	6 F	7 F-G
8 F-P	9 F	10 F-G	11 G	12 F-P	13 P	14 F-P
15 F-P	16 P	17 F-P	18 F	19 P	20 F	21 F-P
22 F	23 F-P	24 F	25 F-G	26 F-P	27 F-P	28 P
29 P	30 F-P	31 F				

EASTERN UNITED STATES TO:												
GMT	00	02	04	06	08	10	12	14	16	18	20	22
Central America	15-20	(15) 30	20 (40)	(20-40)	x	(20)	20	(20)	(15)	(15)	15 (20)	(10) 17
South America	15 (20)	(15) 20	20 (40)	(20-40)	(20)	x	(15)	(15)	x	(10)	(10-20)	(10) 20
Western Europe	20	20	(20-40)	(40)	x	(20)	x	x	x	x	(20)	20
South Africa	x	(40)	x	(20)	x	x	x	x	(15)	(15)	x	x
Eastern Europe	20	20 (40)	(20)	x	x	x	(20)	x	x	(15)	(15)	(20)
Middle East	20	20 (40)	(20)	x	x	x	x	x	x	x	(20)	(15)
India/ Pakistan	(15-20)	(20)	x	x	(20)	x	x	x	x	x	x	x
Far East/ Japan	(15)	x	x	x	x	x	(20)	(15-20)	(15)	x	x	(15)
Southeast Asia	(15-20)	x	x	(20)	x	x	(20)	x	x	(15)	x	x
Australia	(15)	(15)	x	x	(20-30)	(20-30)	(20)	(20)	x	x	x	x
Alaska	(15-20)	(15-20)	(15-20)	20	20 (40)	(20-40)	(20)	(20)	x	x	(15)	(15-20)
Hawaii	(15-20)	(15-20)	(15-20)	20	20 (40)	(20-40)	(20)	(20)	x	x	x	(15)
Western USA	(10) 30	(10) 30	(10) 40	(15) 40	(20) 40	(20-40)	(15) 20	(10) 20	(10-20)	(10-20)	(10-20)	(10) 20
CENTRAL UNITED STATES TO:												
Central America	(10) 20	(15) 30	20 (40)	20 (40)	(20-40)	(20)	(20)	(15) 20	(15-20)	(10-20)	(10-20)	(10) 17
South America	10 (20)	(10) 20	(15) 30	(15) 30	(20-40)	(20)	(20)	(15)	(15)	(10)	(10-15)	(10-20)
Western Europe	(15) 20	20	(20-40)	(20-40)	x	(20)	(20)	x	x	x	x	(15-20)
South Africa	x	x	(40)	(20-40)	(20)	x	x	x	(10-15)	(10-20)	(20)	x
Eastern Europe	(20)	(20)	(20)	(20)	x	x	(20)	(20)	x	(15)	(15-20)	(15-20)
Middle East	(15-20)	(20)	(20)	(20)	x	x	x	x	x	x	(20)	(20)
India/ Pakistan	(15-20)	(15-20)	(20)	x	x	x	(20)	x	x	x	x	x
Far East/ Japan	x	(15)	(15)	x	x	(20-40)	(20)	20	(20)	x	x	x
Southeast Asia	(15)	(15)	(15-20)	(20)	x	x	(20)	(20)	(15-20)	(15)	(15)	x
Australia	(15)	(15)	(15)	(20)	20 (40)	(20-40)	(20-40)	20	(20)	x	(15)	x
Alaska	(10) 30	(10) 30	(10) 40	(15) 40	(20) 40	(20) 40	(20-40)	(15-40)	(10) 30	(10-20)	(10-20)	(10) 20
Hawaii	(15-20)	15 (20)	(15-20)	20	20	(20)	20	(20)	x	x	x	(15)
WESTERN UNITED STATES TO:												
Central America	(10) 17	(15) 20	(15) 20	20	(20)	(20)	(20)	(20)	(20)	(10-20)	(10-15)	(15-20)
South America	(10-20)	(10) 17	15-20	(15) 20	(20)	(20)	(20)	(15)	(15)	x	(15)	(10-15)
Western Europe	(15-20)	(20)	20	(20)	x	x	x	(20)	(15)	(15)	(20)	(15-20)
South Africa	x	x	x	(20)	(20)	x	x	(20)	(20)	(15)	x	x
Eastern Europe	(15-20)	(20)	(20)	(20)	x	x	x	(20)	x	x	x	(15-20)
Middle East	(20)	(15-20)	(15-20)	(20)	x	x	x	x	x	x	x	(20)
India/ Pakistan	x	x	(15)	x	x	x	x	(20)	x	(15)	x	x
Far East/ Japan	(15)	(15)	(20)	(20)	(20)	(20-40)	(20-40)	(20)	(20)	(15-20)	x	(15)
Southeast Asia	x	x	(15)	(15)	x	(20)	(20)	(20)	(15-20)	(15-20)	(15)	x
Australia	(10-15)	(10-15)	15	(15-20)	20	20	20	(20)	20	(20)	x	(15)
Alaska	(10) 40	(10) 40	(10) 40	(15) 40	(20) 40	(20) 40	(20-40)	20-40	(15) 40	(10) 40	(10) 40	(10) 40
Hawaii	(10-15)	(10-20)	(10-20)	(15-20)	20	20	(20-40)	20 (40)	(20-40)	x	x	(10-15)
Eastern USA	(10) 30	(10) 30	(10) 40	(15) 40	(20) 40	(20) 40	(20-40)	(15-20)	(10) 20	(10-20)	(10-20)	(10) 20

***Table 1.** Band, time, country chart. Plain numerals indicate bands which should be workable on Fair to Good (F-G) and Good (G) days. Numbers in parentheses indicate bands usually workable on Good (G) days only. Dual numbers indicate that the intervening bands should also be usable. When one number appears in parentheses, that end of the range will probably be open on Good (G) days only.*

"gold" is to be found: The E-layer often fails to completely disappear after sundown. Operators with sensitive equipment and properly tuned antennas can often take advantage of this weak-but-steady condition and make some surprising contacts, so don't ignore this possibility when the charts show an apparent lack of usable nighttime frequencies.

Happy hunting, and happy Fourth!

Band-by-Band Summary

10 and 12 Meters

Daytime absorption will weaken signals, but reliable DX contacts may be found in the Caribbean and Latin America, with occasional openings to Africa or Australia. Expect signals to peak in the morning or late afternoon, but don't forget that these low bands could stay open well into the evening at this time of year. Expect short-skip to fall between 1,000 and 2,000 miles.

15 and 17 Meters

Viable DX will be available to many parts of the world. Expect the strongest signals in the early morning or late afternoon. These bands should hold up well into the evening throughout most of the month. Look for short-skip out to 2,300 miles.

20 Meters

Good daytime DX will be possible with the strongest daytime signals occurring shortly after sunrise or in the late afternoon or early evening hours. Some decent nighttime DX will also be possible, especially to the west and northwest. Expect short-skip to vary from 500 to 2,000 miles during the day and from 1,000 to 2,300 miles at night.

30 and 40 Meters

Some good DX is likely to be heard throughout the night as long as atmospheric noise isn't too great, but static from nocturnal thunderstorms will undoubtedly dominate many nights. Good daytime openings should again be found between the coasts and to Alaska, but skip will be limited to 750 miles or so. At night, skip can fluctuate from 500 to over 2,000 miles.

80 and 160 Meters

High static will mask signals on these bands most of the time, but occasional weak openings may occur between sunset and sunrise. Peaks will usually come near midnight and in the predawn hours. Short-skip will vary from 1,000 to 2,000 miles.

NEVER SAY DIE

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couldn't get through to him in Africa to say hello some 25 years later. Well, all I had at the time was a dipole antenna.

Barry Goldwater K7UGA was a good friend. I had lunches with him at the Capitol and dinner with him at his home in Scottsdale. I visited for two weeks with King Hussein JY1 in his summer palace, just outside Amman. And recently I visited with Art Bell W6OBB at his home in Nevada. Oh, yes, I had lunch with Freeman Gosden (Amos, of Amos and Andy), at his home.

Bill Leonard (W2SKE), the head of CBS TV news, and I flew around the world together, working thousands of hams on 20m as we flew, and visiting hams in 23 countries.

Hmm, that's about it. How about you?

I admit that being the editor of a ham magazine helped, but what better could a dyed-in-the-wool ham do but be the editor of a ham magazine? Talk about the best in the world of all possible jobs! Nirvana.

Bread

The staff of life, right? No, make that the shaft of life.

Grains make healthy food — when we sprout them, but when we grind them into flour, a process we invented around 10,000 years ago, and which had not existed for 99.999+% of mankind's history, we did not do ourselves any favors.

Robert Crayhon, in his *Paleolithic Diet,* says that the combination of low physical activity, hypercaloric intake, and overconsumption of these neocarbs (new carbohydrates) is at the root of our obesity crisis, plus a long list of other health miseries. His cure is simple — just return to our historical diet of lean meat, seafood, fruits, vegetables, raw nuts, and moderate physical activity.

Our guts over millennia adapted to our eating raw food. Thus, the more you go raw, the healthier you're going to be and the better you're going to feel. You'll lose unwanted weight, have more energy, and even your brain will respond once you stop sandbagging your body with sugar, flour products, and cooked food.

That's right — no pasta, no pizza, no hot dogs, no Big Macs. That is, unless you don't mind being grossly fat, tired all the time, constipaturd, and difficult to live with. Ohh, boy!

I just love the letters and E-mails I'm getting from people who have changed to raw food. They've lost their unwanted weight, and say they're looking and feeling years younger.

Is it really surprising that when you put the wrong fuel into a machine that it's going to work poorly?

In looking through *The Concise Medical Encyclopedia,* a 500-page 1998 book describing thousands of illnesses, I could see that around 99% of these illnesses are caused by a poor diet. And most can be cured by a diet change. It's your health, your body, and your choice.

Con Job!

This whole business of "jobs" is an incredibly enormous con. "Employment" is a scam. You, your folks, and their folks have been conned for the last hundred years or so by the big corporations, the media, our schoolteachers, and the government.

It all started with the industrial revolution, which needed factory workers. They needed to move workers off the farms and onto production lines.

So now we are thoroughly inculcated (brainwashed) into thinking in terms of being workers. Of having jobs. Preferably, secure jobs. We think it's perfectly normal to commute to work on the Long Island Railroad — which I did for almost a year when I worked at Airborne Instrument Laboratories as an engineering project supervisor. I made the hour drive from Brooklyn to Mineola, Long Island, for a while, but at least on the train I could read for an hour. Each way.

Now I see millions of workers driving in heavy traffic to their jobs. It's pathetic! We have people driving two hours into Boston to their jobs every day from New Hampshire. And two hours back, bumper to bumper. Talk about stress! No wonder we're seeing "road rage." And I see this repeated in every city I visit. What does it take to wake people up and realize that they are like oxen in a yoke?

The alternative, you won't be surprised to know, is to own your own business. If your business is at all successful you won't have to commute, you won't have to get permission to take off on a trip somewhere if the fancy strikes. And you will be able to pay yourself whatever the traffic will bear. It makes you feel good when you can pay yourself $500,000 a year. Been-there, done-that.

You don't need any college degrees to run your own business. In fact, a college degree is a serious handicap. That means you've wasted four extremely valuable years and a bundle of money memorizing answers to pass courses which have nothing to do with running your own business. In a year you can learn everything you need to know, with someone else happily paying you to learn.

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NEVER SAY DIE

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Yes, I know I've been writing about this over and over. I even have a $5 book going into the details on the subject. Okay, how many times do I have to write this to get the message across? Please stop being a sucker and working for someone else, complete with commuting. Get the news to teenagers.

Judges' Sweet Deal

Buried in the US Code, 28USC sec. 371 (a) & (b) Article (3) is this gem, in case you're interested in yet another way Congress is spending your tax money for you. District court judges have no retirement or pension plan. Instead, they are appointed for life, so they get their full paycheck, plus benefits, for life — even after they step down. Upon death, under sec. 371 (b) they can assign their paycheck to their wife or a close dependent relative. About four years ago they pushed through a 26% pay increase for themselves to compensate for inflation.

Congress Did It

Maybe you remember the 1990 recession. I sure do. New Hampshire was hit particularly hard, with our unemployment rate making records. What I don't remember ever reading was what caused the recession. How about you?

Donald Trump, who was hit particularly hard by it, going from having several billion to being almost a billion in the red, explained it in his *The Art of the Comeback*. Sherry found the book on sale at a Dollar Store. These stores are springing up everywhere, the 2000s version of the old five-and-dime stores. Well, a nickel in the '30s bought what a dollar does today.

Anyway, what happened was that because of some tax breaks on real estate in the 1980s, developers were building all around the country and banks were doing a land office business with mortgages as real estate values climbed and climbed.

When I sold a bunch of my computer magazines for $16 million in 1983, for tax reasons quite a bit of the money was put into real estate developments. By 1986, at the peak of the real estate boom, Congress decided it was time to rein in developers, so they revised the 1981 tax code with the Tax Equity and Fiscal Responsibility Act of 1986. This not only revised the tax breaks for developers, but was retroactive. My real estate investments, which had been worth millions suddenly were worth virtually nothing. Like this year's dot-com catastrophe.

This was bad enough for business properties, but it also hit the home market, driving home prices down, often far below the mortgage values. It became less expensive to walk away from a house than to keep paying the high mortgage payments, so banks found themselves with rising inventories of vacant homes — and huge losses.

This was when virtually every bank in New Hampshire either went out of business, or was bought for pennies on the dollar by banking conglomerates. And this happened everywhere.

New Hampshire got hit particularly hard because at this same time the microcomputer (the PC) was putting the minicomputer giants out of business.

Thousands of the employees of Digital Equipment, Data General, Wang, Centronics, and Prime lived in southern New Hampshire and commuted to these Boston-area companies.

Not that I hadn't done my best to warn the heads of these companies. I had lunch with An Wang in 1980 and tried to convince him to adapt his office systems to the whole new world of microcomputers. He said I was wrong. I sat down with the other presidents and laid out the future as I saw it, and they all told me I was crazy.

With minicomputers, which a few years earlier had put all but IBM out of the mainframe business, a company wanting to computerize its operation would go to a software developer who would buy the minicomputer from the manufacturer, adapt their proprietary software packages for the customer, and install and maintain the system.

The software usually cost as much as the computer.

Mainframe systems cost about a million dollars, complete with software. Minicomputers cost about $100,000, so they quickly put the mainframe companies out of business. Then, when microcomputers came along with complete systems in the $10,000 range, another 90% drop in cost, I knew minicomputers couldn't last long.

At any rate, Congress managed to put the country into a huge depression for several years, and force thousands of banks out of business. Thanks a bunch, guys.

And what happened to Trump? He got busy making more deals and is doing better than ever.

And what happened to my real estate development investments? Pffft.

Doom!

Ed Dames, a frequent guest on the Art Bell show, did remote viewing for the military for many years. Now he's teaching others how to do it. Ed's been predicting a kill shot to come from the Sun fairly soon, but he's not sure when. This would be a huge flare which would cause a worldwide calamity. That's why he's being called Ed Dooms.

Ed says that the people in the future they were able to remote view were living underground. He also predicted that the calamity would send waves miles high around the globe, with winds in many places over 300 miles per hour. That wouldn't leave much of civilization. Where's my shovel?

My ears perked up when he elaborated on this theme in early March, saying that the killer flare would destabilize the Earth. Hmm, that sounds familiar. That could mean a shifting of the poles, and I don't mean emigration from Krakow and Warsaw.

This is the same prediction made for some time in the next couple of years by Nostradamus, as reported by Dolores Cannon in her *Conversations With Nostradamus*, which I reviewed a while back. He predicted that 97% of the people on Earth would be killed when the Earth shifted on its axis, with the new poles being over Siberia and South America.

Then we have René's *The Last Skeptic of Science*, where he makes a good case for there never having been any ice ages, just pole shifts which have suddenly made new polar regions. This explains why there are places in Siberia and Alaska where there are huge piles of prehistoric animal bones, remnants of some super major catastrophe. It explains why mammoths have been found frozen in Siberia with tropical plants still undigested in their stomachs.

If that's not enough to worry you, then start reading the Edgar Cayce predictions of a pole change coming up in the next few years.

If you are able to snicker all that off, believing that predicting the future is a bunch of baloney, then (a) you've never been to a really good fortune teller, and (b) you're unaware of the work done at the Princeton University PEAR laboratories which has conclusively proven that precognition is a reality. You also haven't read the wonderful book on the subject by Dean Radin, *The Conscious Universe*. Or you're in pathological denial.

Then there's Chet Snow's *Mass Dreams of the Future*. Chet's group hypnotized over 2,500 people, but instead of regressing them to their past lives, they progressed them to future lives. And what they found was that over 95% of them were unable to find a body into which to reincarnate in the 21st century. A few more managed to reincarnate in the 22nd century, and so on. All indicative of some sort of mass human extinction.

Continued on page 64

Wise Up!

Here are some of my books which can change your life (if you'll let 'em). If the idea of being healthy, wealthy and wise interests you, start reading. Yes, you can be all that, but only when you know the secrets which I've spent a lifetime uncovering.

......*Wayne*

The Secret Guide to Health: Yes, there really is a secret to regaining your health and adding 30 to 60 years of healthy living to your life. The answer is simple, but it means making some serious lifestyle changes. Will you be skiing the slopes of Aspen with me when you're 90 or doddering around a nursing home? Or pushing up daisies? No, I'm not selling any health products, but I can help you cure yourself of cancer, heart trouble, or any other illness. Get this new, 2001 expanded edition (156p). $10 (#05)

The Secret Guide to Wealth: Just as with health, you'll find that you have been brainwashed by "the system" into a pattern of life that will keep you from ever making much money and having the freedom to travel and do what you want. I explain how anyone can get a dream job with no college, no résumé, and even without any experience. I explain how you can get someone to happily pay you to learn what you need to know to start your own business. $5 (#03)

The Secret Guide to Wisdom: This is a review of around a hundred books that will boggle your mind and help you change your life. No, I don't sell these books. They're on a wide range of subjects and will help to make you a very interesting person. Wait'll you see some of the gems you've missed reading. You'll have plenty of fascinating stuff to talk about on the air. $5 (#02)

The Bioelectrifier Handbook: This explains how to build or buy ($155) a little electrical gadget that can help clean your blood of any virus, microbe, parasite, fungus or yeast. The process was discovered by scientists at the Albert Einstein College of Medicine, quickly patented, and hushed up. It's curing AIDS, hepatitis C, and a bunch of other serious illnesses. It's working miracles! The circuit can be built for under $20 from the instructions in the book. $10 (#01)

My WWII Submarine Adventures: Yes, I spent from 1943-1945 on a submarine, right in the middle of the war with Japan. We almost got sunk several times, and twice I was in the right place at the right time to save the boat. What's it really like to be depth charged? And what's the daily life aboard a submarine like? How about the Amelia Earhart inside story? If you're near Mobile, please visit the Drum. $5 (#10)

Wayne's Caribbean Adventures: My super budget travel stories – where I visit the hams and scuba dive most of the islands of the Caribbean. You'll love the special Liat fare which let me visit 11 countries in 21 days, diving all but one of the islands, Guadeloupe, where the hams kept me too busy with parties. $5 (#12)

Cold Fusion Overview: This is both a brief history of cold fusion, which I predict will be one of the largest industries in the world in the 21st century, plus a simple explanation of how and why it works. This new field is going to generate a whole new bunch of billionaires, just as the personal computer industry did. $5 (#20)

Cold Fusion Journal: They laughed when I predicted the PC industry growth in 1975. PCs are now the third largest industry in the world. The cold fusion ground floor is still wide open, but then that might mean giving up watching ball games. Sample: $10 (#22).

Julian Schwinger: A Nobel laureate's talk about cold fusion—confirming its validity. $2 (#24)

Improving State Government: Here are 24 ways that state governments can cut expenses enormously, while providing far better service. I explain how any government bureau or department can be gotten to cut it's expenses by at least 50% in three years and do it cooperatively and enthusiastically. I explain how, by applying a new technology, the state can make it possible to provide all needed services without having to levy *any* taxes at all! Read the book, run for your legislature, and let's get busy making this country work like its founders wanted it to. Don't leave this for "someone else" to do. $5 (#30)

Mankind's Extinction Predictions: If any one of the experts who have written books predicting a soon-to-come catastrophe which will virtually wipe most of us out are right, we're in trouble. In this book I explain about the various disaster scenarios, like Nostradamus, who says the poles will soon shift (as they have several times in the past), wiping out 97% of mankind. Okay, so he's made a long string of past lucky guesses. The worst part of these predictions is the accuracy record of some of the experts. Will it be a pole shift, a new ice age, a massive solar flare, a comet or asteroid, a bioterrorist attack? I'm getting ready, how about you? $5 (#31)

Moondoggle: After reading René's book, *NASA Mooned America*, I read everything I could find on our Moon landings. I watched the NASA videos, looked carefully at the photos, read the astronaut's biographies, and talked with some readers who worked for NASA. This book cites 45 good reasons I believe the whole Apollo program had to have been faked. $5 (#32)

Classical Music Guide: A list of 100 CDs which will provide you with an outstanding collection of the finest classical music ever written. This is what you need to help you reduce stress. Classical music also raises youngster's IQs, helps plants grow faster, and will make you healthier. Just wait'll you hear some of Gotschalk's fabulous music! $5 (#33)

The Radar Coverup: Is police radar dangerous? Ross Adey K6UI, a world authority, confirms the dangers of radio and magnetic fields, including our HTs and cell phones. $3 (#34)

Three Gatto Talks: A prize-winning teacher explains what's wrong with American schools and why our kids are not being educated. Why are Swedish youngsters, who start school at 7 years of age, leaving our kids in the dust? Our kids are intentionally being dumbed down by our school system — the least effective and most expensive in the world. $5 (#35)

Aspartame: a.k.a. NutraSweet, the stuff in diet drinks, etc., can cause all kinds of serious health problems. Multiple sclerosis, for one. Read all about it, two pamphlets for a buck. (#38)

$1 Million Sales Video: The secret of how you can generate an extra million dollars in sales just by using PR. This will be one of the best investments you or your business will ever make. $40 (#52)

Reprints of My Editorials from *73*. Very few things in this world are as we've been taught, and as they appear. I blow the whistle on the scams around us, such as the health care, our school system, our money, the drug war, a college education, sugar, the food giants, our unhealthy food, fluorides, EMFs, NutraSweet, etc.

1996 Editorials: 120 pages, 100 choice editorials. $10 (#72)

1997 Editorials: 148 fun-packed pages. 216 editorials. $10 (#74)

1998 Editorials: 168 pages that'll give you lots of controversial things to talk about on the air. $10 (#75)

1999 Editorials: 132 pages of ideas, book reviews, health, education, and anything else I think you ought to know about. $10 (#76)

2000 Editorials: 76 pages (thinner magazine as a result of our slowly dying hobby). $5 (#77)

Silver Wire: With two 5-in. pieces of heavy pure silver wire + three 9V batteries you can make a thousand dollars worth of silver colloid. What do you do with it? It does what the antibiotics do, but germs can't adapt to it. Use it to get rid of germs on food, for skin fungus, warts, and even to drink. Read some books on the uses of silver colloid, it's like magic. $15 (#80)

Colloid Reprint. April 97 article on a silver colloid maker, history, and how to use the stuff. $5 (#98).

Colloid Kit. Three 9V battery clips, 2 aligator clips & instructions. $5 (#99).

Wayne's Bell Saver Kit. The cable and instructions enabling you to inexpensively tape Art Bell W6OBB's nightly 5-hr radio talk show. $5 (#83)

NH Reform Party Keynote Speech. It wow'd 'em when I laid out plans for NH in 2020, with much better, yet lower cost schools, zero state taxes, far better health care, a more responsive state government, etc. $1 (#85)

Stuff I didn't write, but you need:

NASA Mooned America: René makes an air-tight case that NASA faked the Moon landings. This book will convince even you. $30 (#90)

Last Skeptic of Science: This is René's book where he debunks a bunch of accepted scientific beliefs – such as the ice ages, the Earth being a magnet, the Moon causing the tides, and etc. $30 (#91)

Dark Moon: 568 pages of carefully researched proof that the Apollo Moon landings were a hoax—a capping blow for René's skeptics. $35 (#92)

Dark Moon Video: 222-minute exposé nailing NASA with their own photos. If you've watched the NASA films of the astronauts walking on the Moon you wondered at their weird gate. Wait'll you see it speeded up. It looks exactly like they're running on Earth! They catch NASA in dozens of give aways that the photos and films had to have been faked. $46 (#93)

Travel Diaries: You can travel amazingly inexpensively – once you know the ropes. Enjoy Sherry and my budget visits to Europe, Russia, and a bunch of other interesting places. How about a first class flight to Munich, a rented Audi, driving to visit Vienna, Krakow in Poland (and the famous salt mines), Prague, back to Munich, and the first class flight home for two, all for under $1,000. Yes, when you know how you can travel inexpensively, and still stay in first class hotels. $5 (#11)

73 Writer's Guide: It's easy, fun, can pad your résumé, and impress the hell out of your friends. $0 (#78)

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I need some industrial strength stress reduction so send me your Adventures In Music CD catalog

Allow 4 weeks for delivery except foreign, though we try to get most orders shipped in a day or two.

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Barter 'n' Buy

Turn your old ham and computer gear into cash now. Sure, you can wait for a hamfest to try and dump it, but you know you'll get a far more realistic price if you have it out where 100,000 active ham potential buyers can see it, rather than the few hundred local hams who come by a flea market table. Check your attic, garage, cellar and closet shelves and get cash for your ham and computer gear before it's too old to sell. You know you're not going to use it again, so why leave it for your widow to throw out? That stuff isn't getting any younger!

The *73* Flea Market, Barter 'n' Buy, costs you peanuts (almost)— comes to 35 cents a word for individual (noncommercial!) ads and $1.00 a word for commercial ads. Don't plan on telling a long story. Use abbreviations, cram it in. But be honest. There are plenty of hams who love to fix things, so if it doesn't work, say so.

Make your list, count the words, including your call, address and phone number. Include a check or your credit card number and expiration. If you're placing a commercial ad, include an additional phone number, separate from your ad.

This is a monthly magazine, not a daily newspaper, so figure a couple months before the action starts; then be prepared. If you get too many calls, you priced it low. If you don't get many calls, too high.

So get busy. Blow the dust off, check everything out, make sure it still works right and maybe you can help make a ham newcomer or retired old timer happy with that rig you're not using now. Or you might get busy on your computer and put together a list of small gear/parts to send to those interested?

Send your ads and payment to: *73 Magazine*, Barter 'n' Buy, 70 Hancock Rd., Peterborough NH 03458 and get set for the phone calls. The deadline for the September 2001 classified ad section is July 10, 2001.

NEVER SAY DIE

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Is it the Inca calendar that ends around 2012?

Dolores has maps Nostradamus drew of the U.S. and Canada after the catastrophe (page 296, volume 2). It looks like my part of New Hampshire might make it. Whew!

Gordon Michael Scallion K1BWC has been predicting a global catastrophe for this same time period. His future map also shows my part of New Hampshire still a land area. Gordon lives not far from me, so that's reassuring.

So what?

Well, if any of these predictions are right, the world's civilizations could soon be wiped out. Winds and earth upheavals would wipe out all of our energy sources. Solar power might survive, once the dust settles, but no more oil, coal, or natural gas. No hydroelectric dams. No power grid. Most roads would be destroyed. Bridges gone. Radio and TV pfft. The only communication there will be in the world will be by amateur radio — if we have emergency power.

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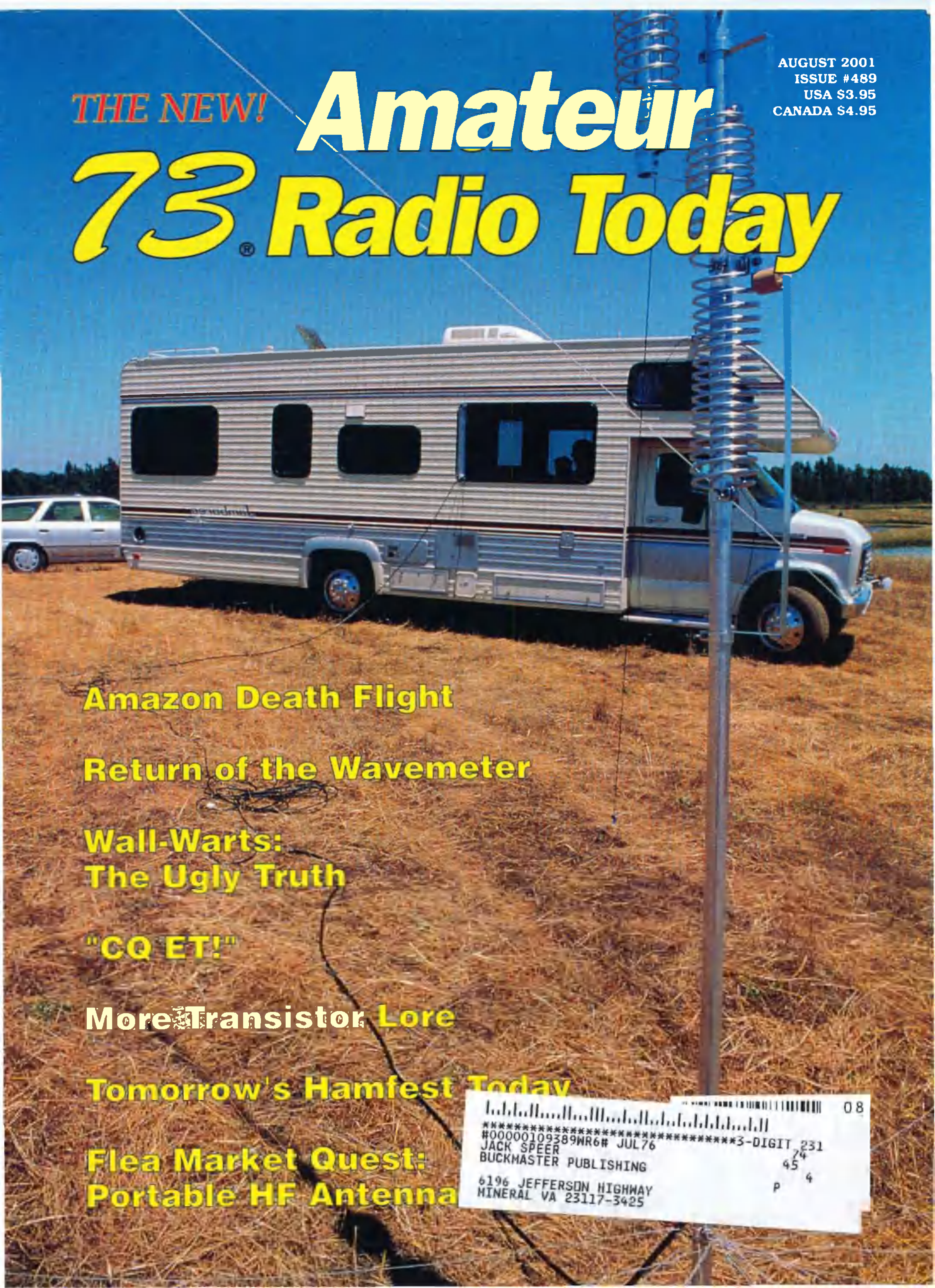
THE NEW!

73® Amateur Radio Today



Amazon Death Flight

Return of the Wavemeter

Wall-Warts: The Ugly Truth

"CQ ET!"

More Transistor Lore

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THE NEW!

73® Amateur Radio Today

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Cover

Tired of hot days and cold nights in tents, in 1999 the New Helvitia (CA) ARC, WR6WR, rented this RV for some Field Day fun in Wilton CA. We are happy to send $100 to Rick McCusker KF6O of Sacramento for forwarding this cover shot. Any other takers?

QRX . . .

FCC to FCC: Restructure Thyself!

The FCC has asked for public input on ways to reorganize the agency. According to a report in *Broadcasting and Cable,* the action comes as the agency prepares to better respond to the consolidation of telecommunications services offered to all Americans.

Under the anticipated change, the FCC's industry-specific bureaus such as Mass Media, Wireless, and Common Carrier are expected to be realigned. This, along functional responsibilities such as licensing, enforcement, and consumer affairs.

The project is being led by FCC Special Counsel Mary Beth Richards, who expects to unveil a reform

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Manuscripts: Contributions for possible publication are most welcome. We'll do the best we can to return anything you request, but we assume no responsibility for loss or damage. Payment for submitted articles will be made after publication. Please submit both a disk and a hard copy of your article [IBM (ok) or Mac (preferred) formats], carefully checked drawings and schematics, and the clearest, best focused and lighted photos you can manage. "How to write for 73" guidelines are available on request. US citizens, please include your Social Security number with submitted manuscripts so we can submit it to you know who.

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Wise Up & Beat the Odds

NEVER SAY DIE

Wayne Green W2NSD/1
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Never Say Die

In 1831 he failed in business — bankruptcy. In 1832 he ran for the legislature and was defeated. In 1835 his fiancée died. In 1836 he had a nervous breakdown. In 1843 he ran for the US Congress and was defeated. In 1846 he was defeated again. In 1848 he was defeated in his third try for Congress. In 1855 he ran for the Senate and was defeated. In 1856 he ran for Vice President and lost. In 1858 he ran for the Senate again, and lost. In 1860 he was elected president.

Abraham Lincoln.

Yep, Another Conspiracy!

Old-timers, which, alas, most of us hams are these days, remember well President Roosevelt's Day of Infamy broadcast, which plunged America into the second world war. There were rumors at the time that Roosevelt had known that the Japanese were about to attack, but withheld this information from his commanders at Pearl Harbor. These rumors were so patently absurd, that they were ridiculed as crazy.

Now comes the exposé by Robert Stinnett in his $16 book, *Day of Deceit — The Truth About FDR and Pearl Harbor.* It's an incredibly detailed exposé of how Roosevelt forced the Japanese into the war, and the cover-up that followed. Roosevelt was warned by the Navy code breakers, as well as through diplomatic channels, that the Japanese had an aircraft carrier attack force heading for Pearl Harbor — and he intentionally kept this information from his Army and Navy commanders.

Now, why on earth would FDR do something so terrible? It doesn't seem to make sense.

Well, FDR had two major problems. The first was the war in Europe, which was going very badly. The Germans had conquered the continent and were getting ready to move on to Britain — and had a good chance of succeeding. But, the American public was vigorously opposed to getting into the war. They remembered the slaughter of millions of soldiers twenty years earlier during WWI. Eighty-eight percent of the public was opposed. Roosevelt knew that with all of Europe under Hitler's control, the next move would obviously have to be to America — so he had to come up with some way to change American opinions. He sure came up with a doozy.

The book goes into great detail, backed up with 116 pages of references, on how his eight-point plan to force Japan to attack us was orchestrated, and how he intentionally put incompetent officers in charge at Pearl Harbor, and then withheld the reports of the Japanese carrier movements from them. He helped see to it that the battleships were in Pearl, but not our aircraft carriers. He felt that battleships were obsolete and worth sacrificing. And so were the lives of our soldiers and sailors, if it would galvanize the American public.

The book contains virtually no speculation. Stinnett spent years forcing the Navy to produce the papers that had been hidden away, marked Top Secret. The National Security Agency (NSA) is still protecting over a hundred thousand pages of relevant documents under the cloak of their being national defense secrets. What a crock!

Our code breakers had broken every Japanese code, so Roosevelt knew exactly what they were doing. The Japanese fleet sent to attack Pearl Harbor was followed every day by our Navy listening stations at Dutch Harbor, Alaska; Samoa; Hawaii; and Corregidor with their direction-finding equipment. FDR knew where they were, and even who their commanders were. He also knew their plan of attack.

The plan sure worked. The day after the attack, the American public had no further reservations about going to war. Congress declared war on Japan on December 8th, and three days later on Germany and Italy.

I said there were two reasons for FDR wanting us in the war. By 1941 America was still suffering from the great depression of the '30s. FDR needed a jolt to get the economy going again. The war effort did that, in spades.

Even though we knew that Japan was gearing up to take over most of Asia — they called it the Greater East Asia Prosperity Sphere — FDR intervened with American authorities to allow them to buy millions of barrels of oil and tons of scrap iron, right up until hostilities started.

We kind of joked at the time that the Japanese had bought the scrap from our tearing down the 2nd, 3rd, 4th, and 6th Avenue Elevateds in New York City, and then were shooting it back at us.

The Pearl Harbor attack came off just as Roosevelt had planned. It got rid of a bunch of the no-longer-needed battleships and totally squelched the isolationists.

Oh, there were rumors at the time, but a panel asked to look into the rumors whitewashed everything, and all of the damning intelligence reports were either destroyed or put into vaults marked Top Secret — where they've remained until Stinnett managed to force them to be revealed.

The Space Station

Didja miss the PBS program on the space station? They tackled the obvious question anyone would ask right up front: What are the potential benefits of the space station to the American people to justify the billions of tax money being spent? Their answer was that, well, maybe it would help scientists discover a cure for cancer, AIDS, or osteoporosis. I'm not exaggerating — that was the explanation! There was no elaboration of why working in zero gravity with very limited lab resources and equipment would speed up this "vital" research.

Nor even a hint that one of the last things in the world the medical and pharmaceutical

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plan later this year. No specific due date for comments was posted by the FCC, but officials say they will be collected over the next several weeks. (Broadcasting & Cable)

Thanks to Broadcasting and Cable, *via* Newsline, *Bill Pasternak WA6ITF, editor.*

What to Do If You Lose Your Purse or Wallet

We've all heard horror stories about fraud that's committed using your name, address, SSN, credit, etc. Unfortunately I (author of this piece) have firsthand knowledge, because my wallet was stolen last month, and within a week the thieve(s) ordered an expensive monthly cell phone package, applied for a VISA credit card, had a credit line approved to buy a Gateway computer, received a PIN number from DMV to change my driving record information on-line, and more. But here's some critical information to limit the damage in case this happens to you or someone you know.

As everyone always advises, cancel your credit cards immediately, but the key is having the toll-free numbers and your card numbers handy so you know who to call. Keep those where you can find them easily (having to hunt for them is additional stress you WON'T need at that point!).

On a personal note, I remember losing an MC, and until I got the toll-free number from information, etc., I was a wreck. File a police report immediately in the jurisdiction where it was stolen — this proves to credit providers you were diligent, and is a first step toward an investigation (if there ever is one).

But here's what is perhaps most important (I never, ever, thought to do this): Call the three national credit-reporting organizations immediately, to place a fraud alert on your name and SSN. I had never heard of doing that until advised by a bank that called to tell me an application for credit was made over the Internet in my name. The alert means any company that checks your credit knows your information was stolen and that they have to contact you by phone to authorize new credit. By the time I was advised to do this — almost two weeks after the theft — all the damage had been done. (There are records of all the credit checks initiated by the thieves' purchases, none of which I knew about before placing the alert.) Since then, no additional damage has been done, and the thieves threw my wallet away this weekend (someone turned it in). It seems to have stopped them in their tracks.

The credit-reporting organization numbers are: Equifax, 1-800 525-6285; Experian (formerly TRW), 1-800-311-4769; and Trans-Union, 1-800-680-7289. The Social Security Administration also has a fraud line at 1-800-269-0271.

From the Internet.

The Bird

The other day I was on my way home from work when the most remarkable thing happened. Traffic was heavy as usual, and as I sat there at a red light, out of nowhere a bird slammed into my windshield. If that wasn't bad enough, the poor creature got its wing stuck under the windshield wiper.

Just then the light turned green and there I was with a bird stuck on my windshield. Without any other apparent options, turning on the windshield wipers seemed the only thing to do. It actually worked.

On the upswing, the bird flew off, and here is the crazy thing ... it slammed right into the windshield of the car behind me. No, it didn't get caught under the windshield wipers of that vehicle, but the car behind me was a police car.

Of course, knowing my luck, immediately the lights went on and I was forced to pull over. The officer walked up and told me he saw what had happened at the light. Trying to plead my case fell on deaf ears. He simply stated: "I am going to have to write you up for flipping me the bird."

Thanks to Stu Greenwood AB7BA, from Giggle Hertz in the November 1998 issue of Radio Flyer.

The DXer's Creed

In the Light of Day, and Dark of Night,
I'll crank my power full to the right,
To show my RF strength and clout,
And repeatedly my callsign shout!

Because I must, I must divine,
If in Lord Howe I'm 5 and 9!
And in Tonga, Gabon, Mayotte,
I need to know my signal's hot!

3B9 and VU7,
Send me straight to DX heaven!
Calls from lands oh so exotic,
If I miss them, I'll go neurotic!

To snag the rare ones, I'll use each trick:
I'll skip work, I'll call in sick!
I'll miss birthdays and traditions,
Just to work DXpeditions!

And when my family members whine,
I'll say, "Hang on, there's VQ9!"
But should I incur some wifely wrath,
I'll just cry, "Not now! Ten's hot long-path!"

To keep my rep as pile-up buster,
I stay logged on the DX Cluster,
And I read each bulletin,
QRZ and Ohio Penn.

And though my money gets swiped by tramps,
I'll keep mailing crisp "green stamps,"
In the hopes my work so hard,
Nets for me a third-world card.

The QSL, the Holy Grail!
The DXer's joy that comes by mail.
And though we prize these souvenirs,
It sure takes long — it seems like years!

With each contact I near my goal
Of DXCC Honor Roll.
And with ev'ry packet spot I'm seein',
I keep hopin' for a North Korean!

And so I'll say, "5-9, 7-3,"
"By the buro's fine by me!"
By Boulder K and Grey-line edge,
I promise here, I make this pledge:

In the Light of Day, and Dark of Night,
I'll crank my power full to the right,
To show my RF strength and clout,
And repeatedly my callsign shout!

Thanks to K5IQ, in the January 2000 issue of The MHDXA Wire.

Microwatt DX

Yes, microwatts, and remember: A microwatt is just one millionth of a watt!

KJ5TF, on his Web site, reports some real beaut DX! 28 MHz: K7IRK contacted A6YPE using just 6 microwatts: 1,300 miles was the distance.

On 21 MHz, the Atlantic was bridged by GØIFK and K1RM back in 1991. GØIFK used less than 40 microwatts to make the 3,200-kilometer contact. Even 160 meters can produce results with microwatts. AA2U contacted CH9ASJ over a 522-mile path with 613 microwatts.

VK4 amateurs figure in the results for an FM contact made on 10 GHz. VK4ZSH and VK4ZNC were able to make contact with just a milliwatt. The distance spanned was 124 miles.

Some Timely Advice ... Free!

Imagine there is a bank which credits your account each morning with $86,400, allows you to keep no balance from day to day, and every evening cancels whatever part of the amount you failed to spend during the day. What would you do? Why, draw out every cent, of course!

Well, everyone has such a bank. Its name is TIME. Every morning, it credits you with 86,400 seconds. Every night it writes off, as lost, whatever you have failed to invest in good purpose. It carries no balance. It allows no overdraft. Each day it opens a new account for you and each night, if you fail to use the day's deposits, it's gone! The loss is yours. There is no going back.

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industries want are cures for these illnesses. These are huge money-makers, and not to be messed with.

I got a particularly good laugh from this nonsense because drug-free cures for these illnesses have already been discovered. They're easy to cure unless you have been so totally brainwashed into believing what doctors say that you refuse to do even a little bit of reading on the subject. The snake oil and quackery are provided by the AMA, FDA, NIH, the medical schools, the insurance and drug companies. The delivery boys are the MDs.

So why is Congress reaching deep into our pockets to fund the space station? Ask the Boeing stockholders, since they'll be getting a lot of the benefit. Ask the companies doing the work for NASA how much their lobbyists had to bribe Congressmen and Senators to get this huge lump of pork to fly. Who says pigs can't fly?

How come the Russians, who never had a lot of money to waste on inconsequentials, spent billions of rubles to loft *MIR?* Their original idea was to build a space station as a spy platform, complete with nukes ... just in case. It was always 100% a military project.

Benefits? Can you find any- one who can name one single scientific benefit that has emerged as a result of research done in our space station, or resulted from work in the Russian stations?

It's nice that the Russians are now our partners in the space station effort. But, according to the PBS report, we're having to pick up the tab before the Russians will do any work on their modules.

The billions for all this doesn't come out of Congress's pockets, just yours ... sucker.

Defense?

Dan Quayle (anybody remember him?) has been wringing his hands over the shrinking of our military might. He frets that in the last decade we've cut the number of army divisions from 18 to 9. The navy has shrunk from 600 ships to 300. The number of air wings from 36 to 18.

Ten years ago we'd built up a military system as part of our Cold War strategy. Considering that the main threat from Russia wasn't a war played with ships, planes, and tanks, but of nuclear annihilation from missiles, perhaps Congress let those old generals and admirals keep to their old habits too long.

History has shown us endlessly that our military leaders have never accepted new technologies without a long, bitter battle. Just like our schoolteachers. And our scientific establishment. And our medical establishment.

How many ships, planes, and tanks did we need to put Saddam out of business? Well, almost out of business, at least for a little while. And our invasions of Haiti, Panama, Somalia, and Grenada? Or our adventure into Yugoslavia?

We're worried about North Korea, Iran, more Iraq, and maybe Qaddafi a little. But these pipsqueaks are more likely to play the terrorist game with suitcase nukes and biologicals, from which no amount of army divisions or navy ships are going to save us.

Then there's China. The communist Chinese leaders are a proven royal pain in the butt. How much the rising tide of capitalism will rock their boat is yet to be seen. And, like our standoff with the USSR, this is most likely going to be another nuke problem, not the number of army divisions we're keeping out of our workforce at public expense.

Nukes are a problem. A big problem. We can spend billions or even trillions developing antimissile defenses, but that isn't going to keep even a small country from smuggling in dozens or even hundreds of nukes. Plus the makings for tons of biologicals. That's a lot cheaper way to deliver the goods than via multi-million-dollar guided missiles (which leave a clear signature telling us exactly where they came from).

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LETTERS

From the Ham Shack

C. Arnett KD5GGF, Blooming Grove TX. Keep up the good work and the editorials. Someone has to let the citizens of the USA know how the cow eats the cabbage, esp. with that bunch in Washington DC.

I wish you would do an article on one-world government and the Trilateral Commission. You briefly touched on it several months ago, so readers are primed for the truth. If we ever lose our Second Amendment rights you can bet that they will ram one-world government right down our throats. There won't be anything we can do about it when it happens. No Second Amendment means no fight back.

One last thing concerning health. Diet and exercise will cure most health problems, including depression. I was a Type II diabetic, 6', 250 lbs. Disgusting fat body. I had the lifestyle of a neutered domestic house cat. Blood sugar out of control, high blood pressure, high cholesterol, at 36 years of age. I was dead, I just had not fallen over yet. I did the pill thing with the doctor. It sort of worked, getting the sugar under control, but the side effects from the drug were not a good thing. Long-term use was kidney failure and heart problems. I knew I had to do something else. I started reading about diabetes and diet and exercise regimens and applied it to my situation (travel), and made it work. I just turned 39 years. I now weigh 198 lbs, the problems have gone away, and I feel great. The people who are grossly overweight need to pull the feed trough out from under their face and start moving around and doing exercise and most, if not all, of their health problems will go away.

The doctors certainly are not going to push the diet and exercise thing, because it is too simple and will not make them any money. People are very mistaken if they think a pill will make the problems go away. It just masks the problems with a Pandora's box of other problems that will come later from the meds.

Now, to the morbidly obese: "You're dead — you just ain't fell over yet!"

Thanks again, Wayne.

Keep at it, but you need to take off another 30 pounds, at least. The Trilateral Commission? I'm treading on dangerous enough ground with my pushing cold fusion, thus stepping on the toes of the oil, coal, natural gas, nuclear power, solar, wind power, and hydropower industries, plus the $1.5 trillion medical industry, plus NASA's Moon hoax, which has claimed a bunch of lives already. Now you want me to poke the small group that owns and is running the world you know where? No thanks. — Wayne.

Ronald Blaine Fox N9LXX. Amateur Radio is the promotion of goodwill internationally. It truly helps to break down barriers, and open communications between our nation and citizens of other nations. I will never forget talking to a gentleman in the Middle East in 1993, whose country was in turmoil. While he was speaking, I could literally hear bombs dropping in his neighborhood. This particular incident did not involve the United States, however, the amateur to whom I was speaking had concerned relatives in the U.S., and all of their phone communications were down. I can't explain the thrill of being able to call this gentleman's family in Georgia and letting them know that he was OK. A truly emotional experience, even for me, who was only passing a message along. This is just one specific example of the type of international goodwill in which I have been involved. Many others have more glorious stories than I, to be sure.

James E. Cornell KB1GDL. On page 39 of *73*, May 2001 issue, there is a short piece entitled "Take My License — Please!" The two Kentucky hams mentioned, Stephen Anderson, ex-AA8DP, and Charles Puckett KF4ZMG, are both high-ranking members of the Kentucky Unorganized Militia. Unlike most militia groups in this country, who are primarily interested in creating a show of force and solidarity in favor of and protecting Second Amendment rights, this Kentucky group seems actually anxious to provoke an armed confrontation (and they are VERY well armed), with any possible agency of the federal government. Stay tuned, I don't think we've heard the last of either of these fellows. I would be willing to bet that AA8DP is still on 80/75 meters as a communications officer for the K.U.M., and I doubt that a forfeiture notice would faze him. I may start listening on 3.860 to see if I'm right.

Great magazine, from one libertarian to another. Expect a change of address in a couple of months. I'm out of here for central Arizona as soon as I sell my house. 73!

Professor Louis Peasley, State College PA. Mr. Green: My son serves as a Petty Officer 2nd Class nuclear reactor operator on the *USS Alexandria*, a fast attack based in Groton. Before he left on deployment in November, I gave him your book of submarine stories.

Your book was a hit on the boat. Seth left it in the torpedo room (where he sleeps) and the EOW found it. For several days, your book was the topic of conversation among the engineering crew.

Thank you for your sharing all those stories.

Larry WDØAKX, Albert Lea MN. Hi, Wayne. I have enjoyed your mag since I became a ham in '77.

You are always wanting your readers to write with our experiences, so I just had to tell you about the wonderful customer service that I received from Yaesu!

I was experiencing a problem in programming my new FT-7100M, which is a terrific rig, but I couldn't lock out channels in the memory scan. I went to the Yaesu Web site, found the E-mail tech service link, explained the problem, and within 30 minutes I received a reply telling me what to do to correct the problem! According to the site this was even after-hours for replies.

It was a misprint in the manual. I am not used to this good a service so just had to pass that along for what it is worth. I will be buying more of their products in the future because of this!

If only more manufacturers could have tech service this good!

Keep up the good work, Wayne. I have been reading all of the Moondoggle stuff and am also convinced. 73.

Has anyone else had a good customer service experience? Please advise. — Wayne.

Richard Mollentine WAØKKC. This 11-year sunspot peak cycle is less than desirable, although many have had magnificent individual contacts.

We are now going down in sunspots. To alleviate the progress downward and put our best face forward, I'm suggesting it be known as a 5-1/2-year sunspot cycle — or in other words, in 5-1/2 years it will start up again, hopefully much better.

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Amazon Death Flight

When these missionaries — and hams — were shot down, the official apology was too little, too late.

A hail of bullets striking the Cessna 180 ignited a fire in the cockpit, filling it with smoke and flames. Jim Bowers KD4CKM, sitting in the copilot's seat, grabbed a fire extinguisher and tried to put out the flames. But they continued to build behind him, surrounding his wife, Veronica (Roni) Bowers KD4CKN, 7-month-old daughter Charity, and 6-year-old son Cory, sitting next to his mother.

It was April 20, 2001, when a Peruvian jet fighter came up alongside the plane on the right, flew there for a moment, and then disappeared. The fighter then came in from behind and opened fire, spraying the plane and its five passengers and ripping holes in the fuselage and pontoons. A single bullet hit Roni in the back, going through her heart, and entered through the back of Charity's head, instantly killing them both.

The pilot, Kevin Donaldson, had both legs shattered by the gunfire. In the panic of the moment he shouted into the radio, telling the control tower at the Iquitos Airport in Spanish that "They are trying to kill us." He frantically dove the plane toward the Amazon River, as he knew he had to land — and quickly. The river is two miles wide at the point where they crash-landed.

Without the use of his legs, Kevin was unable to keep the plane from hitting the water hard. However, the craft still managed to stay afloat for a short time. The Peruvian fighter came in for the kill, and sprayed the plane with bullets again. Jim opened the door, and the intensity of the fire increased. He got out of the plane and reached back to pull Cory to safety. He then went back for his wife and daughter. Once they were out of the plane it started to roll over and sink. Jim and Cory hung on to the pontoon while trying to keep Roni and Charity from floating away.

The water was on fire, as flames from the cockpit ignited the gas spilling from the ruptured wings. Kevin, the pilot, tried to get out of the cockpit, and discovered his right leg wouldn't work when he tried to step on the pontoon. He fell off into the blazing inferno and fought valiantly to splash and force the flames back from him as he swam around the plane calling for Cory to get on his back.

Photo A. Jim Bowers, Roni, Charity, and Cory. Photo by Daniel Enck.

Jim and Cory were also splashing to keep the flames away from them. Finally the gasoline burned out and the smoke cleared, leaving visible the scene of their plight in the middle of the Amazon River. The survivors clung to the pontoons for a half-hour, until a native from a village upriver came in his canoe to rescue them.

The Peruvian government said that the fighter pilot thought they were drug runners and tried to warn them to land. Kevin apparently never heard the warnings, as he was getting his landing instructions from the tower to land at Iquitos.

A U.S. Embassy official said that a U.S. surveillance plane monitored Peru's downing of the plane carrying the American missionaries. "There was a U.S. government tracking aircraft in the area in support of the Peruvian intercept mission. As part of an agreement between the U.S. and Peru, U.S. radar and aircraft provide tracking information to the Peruvian Air Force on planes suspected of smuggling illegal drugs in the region. The U.S. aircraft are unarmed and do not participate in any way in shooting down suspect planes," he said.

Jim and Roni Bowers were missionaries traveling along the Amazon visiting villages and establishing churches. Amateur radio was a vital link for them. When one of them would go ashore and the other stayed behind, they used two meters to keep in contact.

The Amazon River, and a metal houseboat with a metal roof, provided an excellent reflective surface for the Cushcraft R5 vertical antenna Jim and Roni used on the low bands. Jim was using the same Kenwood TS-430S transceiver that his father, Terry Bowers WB8PAP/PP8ZAN, had used when he himself was in the missionary field in Brazil.

Starting in 1963, Terry Bowers and I had communicated two to three times a week while running phone patches back to family, friends, and supporting churches here in the States. We would meet on the Halo net on 15 meters and then move off to a quieter spot to talk. We would often go to 10 meters and have excellent contacts when the band was devoid of any signals. Ten meters would be open, but no one was listening.

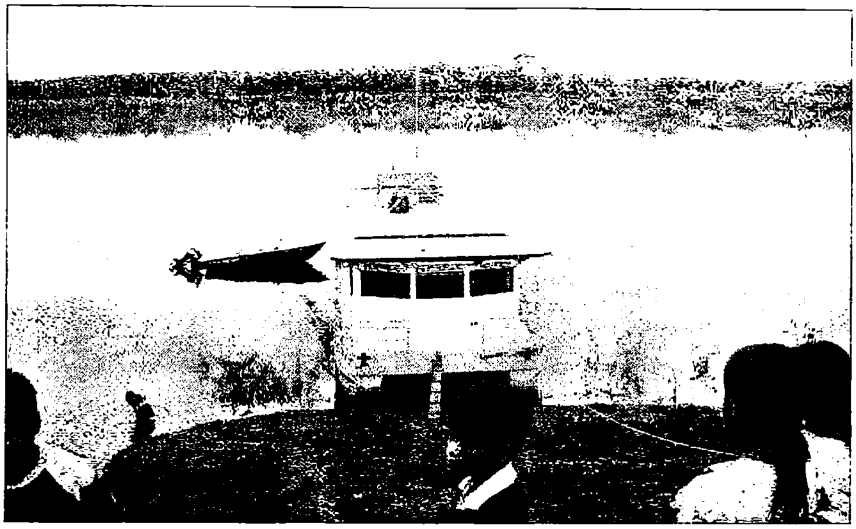

***Photo B.** Here is the Bowers' houseboat, with a Cushcraft R5 not too visible on the roof. Photo by Daniel Enck.*

Jim and I ran phone patches for a while, but the age of computers had made newer technology available that could get the job done faster. Using Pactor, Jim was able to send and receive E-mail at his leisure. He had to run the onboard gasoline generator for power, and with the high cost of gasoline he only ran it when he needed to. It wasn't the same, but still everyone could communicate with them.

The radios on the houseboat are now silent. Jim has returned to the States and may not return to the Amazon. He is staying with family and trying to put his life back together for himself and his 6-year-old son Cory. We communicate by telephone and E-mail, but no longer by ham radio. Thirty-eight years of communicating with the Bowers family by amateur radio in South America have now come to an end.

If you're a No-Code Tech, and you're having fun operating, tell us about it! Other No-Code Techs will enjoy reading about your adventures in ham radio—and we'll pay you for your articles. Yes, lots of nice clear photos, please. Call Joyce Sawtelle at 800-274-7373 to get a copy of "How to Write for *73* Magazine."

Leslie H. Varnicle WA3QLW
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Elizabeth CO 80107-8427

"CQ ET!"

The UFO Watchtower DXpedition.

Located in south central Colorado at almost 8,000 feet above sea level, the San Luis Valley is the highest Alpine valley in the world. This valley is bordered by some of Colorado's highest peaks, many of which are over 14,000 feet. The valley provides a beautiful vista surrounded by snow-capped peaks even in the spring and fall, with a high and dry climate and 350 days of sunshine a year.

In 1708, Juan de Ulaterri claimed the San Luis Valley for Spain. Long before his arrival, the local Indians knew the place as Peaceful Valley. The Ute Indians considered the valley a holy place, and some of the Pueblo tribes considered the valley a Place of Emergence.

Spanish farmers and ranchers have lived in the valley since the 18th century. This high-plains valley, like the plains in the Andes, is famous for potatoes and other produce that favor this elevation and climate. This valley is also known for its "high strangeness."

Stories of supernatural phenomena abound in this naturally spectacular 50-mile-wide by 125-mile-long valley, surrounded by the San Juan and Sangre de Cristo mountains and location of the Great Sand Dunes National Monument.

Ancient Native American traditions exist telling of the existence of underground "ant people." There is also the case of a "bilocating nun" who seems to have astral-traveled to the valley in the 17th century, converting many of the Native Americans to Christianity. The native tales of the phantasmal "blue lady" were brought back to Spain and saved Sister Marie de Jesus from being declared a witch.

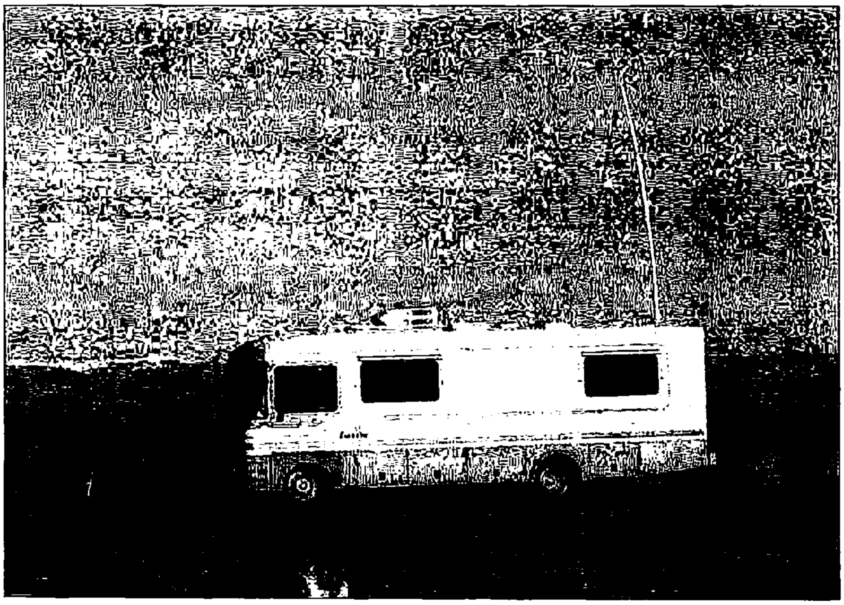

Photo A. CQ ET station.

Modern strangeness

Modern high-strangeness in this valley gathered public attention in 1967 with the sensational animal mutilation of Snippy the horse. The reports of strange lights and craft have continued to put the valley in the limelight, with many modern-day sightings.

In 1995, a daylight video of a huge craft "at least a mile in length" was made by a Salida, Colorado, resident and publicly shown on the Paramount Television program "Sightings." Many locals have reported seeing strange craft approach, then disappear into the mountains. Reports also abound of strange underground noises such as

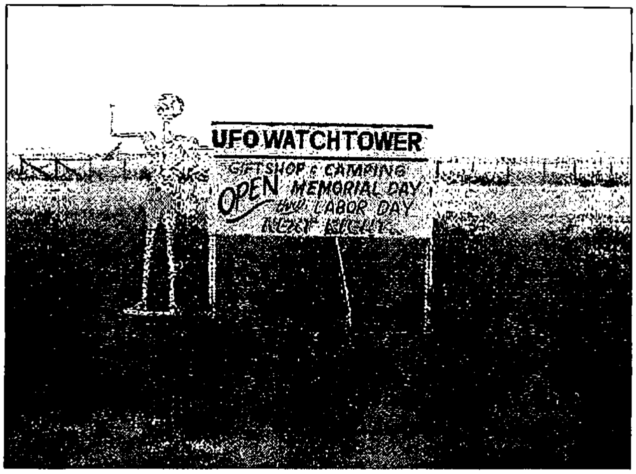

Photo B. Watchtower welcome.

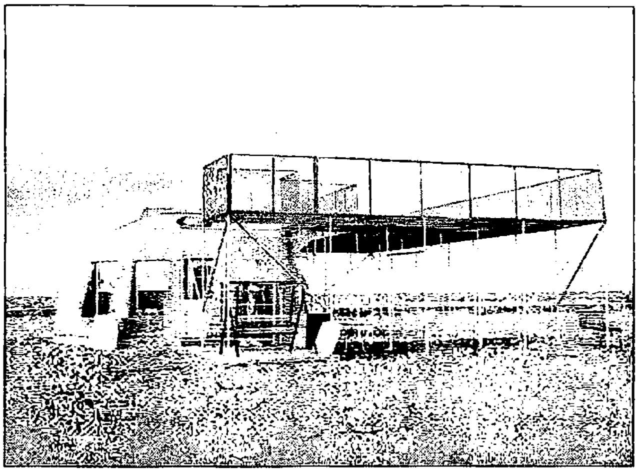
Photo C. UFO Watchtower.

humming and rumbling. In all, the "high-strangeness" of this valley has attracted the attention of researchers of and those interested in the unexplained.

Now they really will get strange

What does all this have to do with ham radio, you are by now asking yourself? If you have an interest in the unexplained, or are an "interesting QSL" hunter, then this upcoming DXpedition is for you.

Having an interest in the unexplained myself, I have decided to commence on a series of DXpeditions to the areas of unexplained happenings in the United States. The first DXpedition will be to the UFO Watchtower in the San Luis Valley of Colorado. The Watchtower is located about 22 miles North of Alamosa CO, and about 220 miles southwest of Denver CO.

In order to check out the possibility of a DXpedition to this and other locations, I set out for a mini-test of the environment, rig, operator, and motor home. Braving snow-covered passes and high winds in early April, crossing the Colorado mountains in a motor home is no task for the faint-of-heart.

Upon arriving in the valley, the operations team — consisting of me and a friend who is presently studying to be a ham — found our way to the UFO Watchtower, which is located about two miles north of Hooper CO near, of all things, an alligator farm. Do the ETs like gator?

We set up a G5RV (a motor home is an RV, so the antenna seems appropriate), and connected it to my trusty old Kenwood 440S. Even though the test was unannounced and we had to brave high winds and constant sandstorms, we managed 30 contacts during our weekend test. The photos show an area that is literally in the middle of nowhere, a remote area just right for "high strangeness."

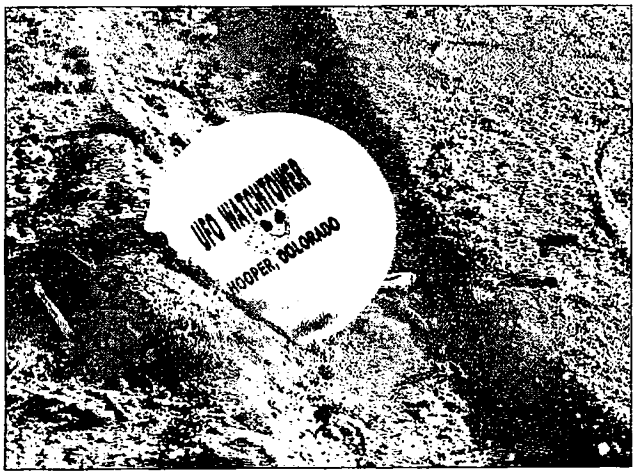

Photo D. UFO crash at Hooper, CO.

The "official" DXpedition will occur over the Labor Day weekend (September 1–3) and the frequencies listed will be used as the spot frequency plus or minus QRM. Give a call, or listen, and you may be the one to hear first-hand descriptions of any strange happenings that may be encountered!

QSL cards should be sent to my *Callbook* address and include an SASE large enough for an 8-1/2 by 11 QSL.

Where and when will the next DXpedition be? I'm thinking Roswell! Keep watching *73* for details!

Frequencies of operation

All frequencies will be ± QRM. 75 meters = 3853. 40 meters = 7237. 20 meters = 14310. 17 meters = 18150. 15 meters = 21385. 10 meters = 28510.

William Call KJ4W
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Murray KY 42071

The Wall-Wart Bible

Say "Amen!" to this treatise on troubleshooting these ubiquitous supplies.

Because failure of electronic equipment is often traceable to a failure of the power supply, it is helpful for the radio amateur to have an understanding of some rudimentary troubleshooting techniques for simple supplies.

The job of the "power supply" in consumer-electronic equipment is to convert the 120 VAC of the power line to low-voltage DC, which is required to operate the equipment. There are also safety factors involved, such as a fuse. The final DC output voltage must be fairly "pure" or "clean" — in other words, free of AC "ripple" components. Finally, sometimes the power supply must have extra efforts made at "regulating" its voltage value.

We can draw a block diagram showing the stages or steps involved in the action of the entire power supply (**Fig. 1**). The transformer, and usually some of the other components, is often housed in a plastic container that is designed to be plugged directly into the wall outlet. This box hangs from the outlet and is often nicknamed a "wall-wart." **Photo A** illustrates a typical "wart." Yes, wall-warts may be ugly, but in defense of this technique, they are an inexpensive way to construct the power-supply housing, and the equipment is smaller and lighter as a result.

One of the challenges in testing power supplies that use the wall-wart technique is that it's often not immediately obvious how much of the whole power supply is in the box, and how much of it is mounted inside the equipment that it powers. In other words, sometimes the wall-wart contains only the fuse and transformer; sometimes the diodes are in it as well; sometimes the capacitor is, too; and occasionally a regulator might be, also. Hopefully, the label can be read to interpret what's inside. There are these possibilities:

1. If it's just a transformer, the output will be low-voltage AC, point 1 in **Fig. 1**. To test a wall-wart made this way, plug it into the wall outlet and check its output with an AC voltmeter (a multimeter set on VAC works fine). The meter should read a little higher than the label rating, if no load is connected.

2. If the rectifier is included with the transformer, but no further components, the output will be at point 2 of **Fig. 1**, and will be rough low-voltage DC. Check it with a DC voltmeter, but realize that the voltage may check quite differently than what is labeled, because the filter capacitor isn't present when you test just the wall unit and meters respond differently to rough DC. Either higher or lower readings than the label value might be observed; about all that can be determined

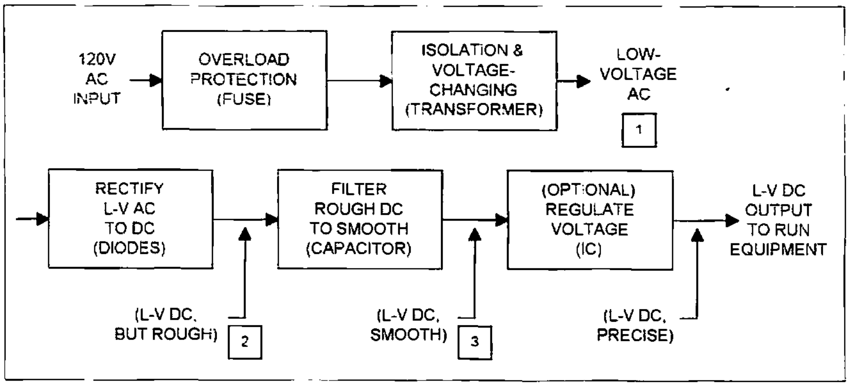

Fig. 1. Block diagram of a typical power supply.

is that the unit produces "in the ballpark," or not at all. Whether or not the supply is connected to a load will produce variation in the output, too.

3. If the capacitor is also included, the output will be nearly pure low-voltage DC, at point 3 of **Fig. 1**. Check it with a DC voltmeter, but realize that the voltage will undoubtedly be higher than labeled because the equipment isn't loading down the capacitor's peak voltage. Capacitor filters with no load have considerably higher output voltage than when fully loaded.

4. It's not too often that a voltage-regulator is included in the wall-wart, as space is limited. Sometimes, however, in larger boxes, they might be included. If that is the case, the output should be very pure low-voltage DC and very close to what is labeled.

The presence of an internal capacitor or regulator within a DC supply is usually not evident from the label. Of course, an oscilloscope can be used to determine if the output waveform is filtered or not. Though a very powerful instrument, it's not always convenient to use an oscilloscope.

It's fairly easy to determine the presence of a capacitor, however, using just a DC voltmeter. Measure the power supply's output with no load, and then unplug the supply while continuing to monitor the voltage. If no capacitor is present, the output voltage will drop to near zero in less than a second after being unplugged. If a capacitor is present, the voltage will drop much more slowly. It will also be considerably higher than the label value, unless there's an internal regulator. Incidentally, keep these principles in mind when checking a wall-wart that's supposed to have a capacitor inside. If it produces output that is too low in voltage and drops to nearly zero very quickly after being unplugged, the capacitor might be open (bad). A variation of this — a unit that is labeled for voltages when connected to an external capacitor — is shown in the examples of real units that follow.

Occasionally, a supply may test OK into a meter, but may still not work properly when hooked to the equipment. A bad connection or an open diode in a multiple-diode rectifier arrangement can produce misleading information of this type. A better test would be to rig up a dummy load to simulate how the equipment pulls operating current from the supply. A light bulb of about the proper voltage rating and a current draw equal to or somewhat less than the rated current of the supply is a good load, and gives visual indication of what's going on as well. If a suitable resistor load is available, that's fine also. Use Ohm's law to figure the proper resistor load: R (ohms) = V (volts) / I (amps). If the supply is rated in mA, first convert to amps by dividing the mA rating by 1,000. Also make sure that the resistor you use for the dummy load has enough power rating: Calculate the power rating needed using P (watts) = V (volts) x I (amps). In nearly all cases, the common 1/4-watt

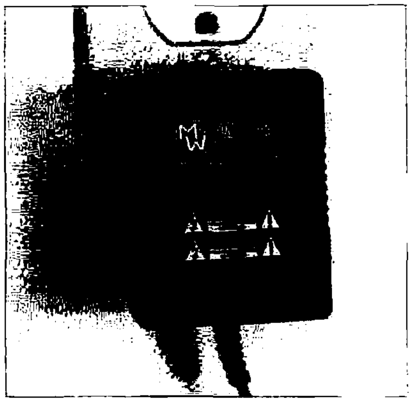

Photo A. A typical "wall-wart" power supply.

resistor won't be enough, and would go up in smoke if used. A resistor of any power rating above what is calculated is fine. For example, to test a 12 VDC, 500 mA power supply under full load would require a resistance of 24 ohms, with a power rating of 6 watts or more. If you don't have the calculated value of resistance for an exact full load, use something higher in resistance. For the above example supply, if you had a 50-ohm resistor handy, it would load the supply to about 240 mA, according to Ohm's law. It would need to have a 3 watts or greater power rating. This load might be adequate to reveal any serious problems in a suspected supply, even though it's not a "full" load.

Usually, these wall-warts are sealed up and no internal repair is practical. However, one that is snapped together or assembled with screws may be opened, and a repair can be attempted. The "fuse" might not be obvious, because it is often hidden inside the transformer windings. It might even be just a section of smaller wire connected from the plug to the transformer. Often "thermal" fuses are used. These devices have a distinctive bullet-shaped silvery case. They open in response to high temperatures more than to current overloads. They should be replaced by using a replacement of the same temperature rating, which is usually marked on the case. Diodes can be replaced fairly easily, though you may not be able to identify the original diode type number. A general-replacement type diode can nearly always be used. To simplify this, just choose a diode of sufficiently higher current and voltage ratings than the supply. I usually use replacement diodes with 200 or 400 volts PIV rating; they cost hardly any more than 50-volt diodes and provide a higher margin of safety. Type 1N4004 (1 amp, 400 PIV ratings) works fine for most LV supplies up to 800 mA or so. ECG125 (2.5 amps, 1 kV) is fine, too, though I don't push that current rating.

Sometimes a wall-wart problem is external and easily repairable. If a sealed supply tests bad, examine its output wire for breaks before discarding it. Sometimes the failure is there, and splicing in a replacement wire or connector might be acceptable. The most likely areas for failure are where the wire is stressed the most, such as the point where the wire joins the case or at the other end near the connector. The wire conductor can break inside the insulation with very little outside visual evidence, so this can be hard to spot. Wiggling the wire while measuring the output voltage, or observing the equipment for response can sometimes reveal the area of the break. A wire break near the connector will probably require that a new connector be purchased and soldered on. See the section near the end of this article for a discussion of typical connectors.

A quick check can be made to see if a supply failure is on the input side or output side: use an ohmmeter set on a moderately low range, say 2k ohm, and probe across the 120 V prongs (with the supply unplugged, of course!). If the fuse and transformer primary winding are good, you'll see a resistance indication of between about 50 ohms and 1,000 ohms. If that's the case, the problem may well be in the output wire or connector, which would be something you can fix even if the supply is sealed. If the resistance across the 120 V prongs is above 2,000 ohms, then either the transformer primary or the fuse is probably open, and unless the supply can be disassembled, there's not likely anything you can do to repair it. If the primary tests good and the output wire seems good also, it's possible that the transformer secondary or the diodes or capacitor (of a DC supply) have failed. With a sealed supply, that's also a difficult situation to fix.

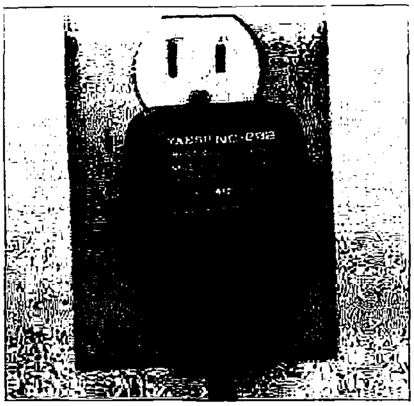

Photo B. A wall-wart used as a battery charger for a Yaesu handheld radio.

Name	Ratings	Cap?	No-load Voltage	Full-load Voltage	Primary resistance
AC Adaptor AE-2086	10 VAC, 500 mA	n/a	12.2 VAC	10.3 VAC	190Ω
Yaesu NC-28B Battery Charger	8.7 VDC, 60 mA	No	11.6 VDC	8.0 VDC	620Ω
AT&T Model DV-7520	7.5 VDC, 200 mA	Yes	11.4 VDC	7.95 VDC	335Ω
Realistic 19-1120	12 VDC, 100 mA	Yes	16.2 VDC	12.5 VDC	452Ω
MW 1250	12 VDC, 500 mA	Yes	19.5 VDC	12.1 VDC	180Ω
AU48-120-120T	12 VDC, 1200 mA	No	14.8 VDC*	9.87 VDC*	52Ω

*Table 1. Measurements of typical units. *This unit does not have an internal capacitor, but evidently relies on one being present in the equipment to which it is connected. With a large (2200 µF) capacitor connected externally, its output voltage is 19.9 VDC without load, and 12.1 VDC fully loaded. The label doesn't reveal all details.*

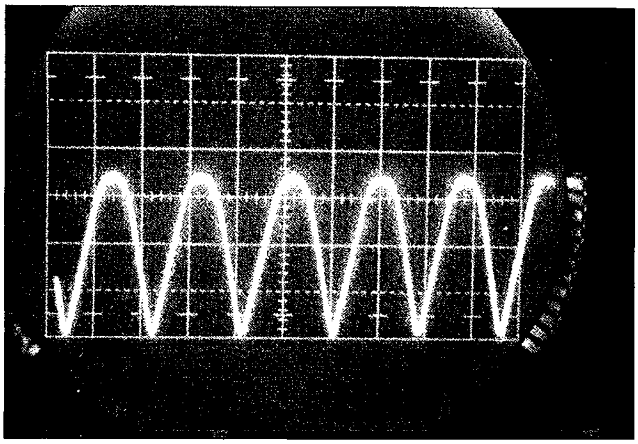

Photo C. The no-load output waveform of the battery charger of ***Photo B****. Vertical scale is 5 V/div, indicating about 17 Vpk; the effective DC voltage as read by the DMM was 11.6 V Unfiltered 120 Hz ripple is evident.*

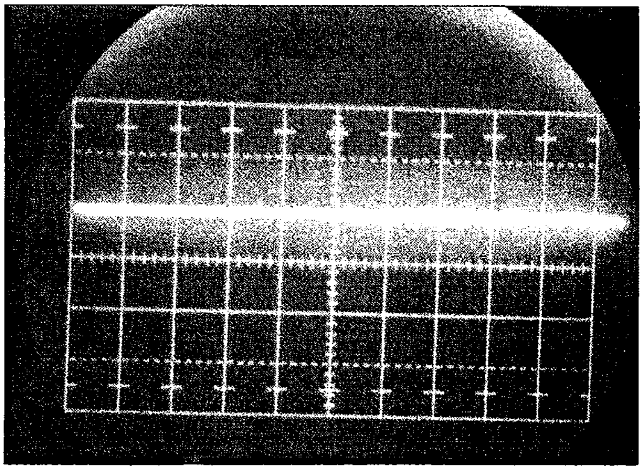

Photo D*. The output waveform of a filtered power supply shows 19.5 V of essentially pure DC, with no ripple. The oscilloscope settings are the same as for* ***Photo C****.*

If you're replacing an output wire or connector, or using a different supply as a replacement, remember that DC supplies must be correctly polarized; hook it up backwards and the equipment will likely burn up! The label information will usually indicate which connector pin is positive. If not, use a voltmeter to determine. There's usually no polarity problem for AC outputs.

Remember that usually some portion of the power supply is in the equipment, and some in the wall-wart. Even if the wart part is good, you can still have problems in the equipment portion of the power supply. Therefore, if power supply problems are still indicated (a completely "dead" set, for example), you will need to troubleshoot the other components: the rectifier diodes (if in the equipment), capacitor, regulator, and wiring. Inside the equipment may also be another fuse, or a fusible resistor; and another frequent source of problems to look for is at the power-supply connector inside the equipment. Here, the stress and movement of the power-supply wire often causes a fatigue failure of solder joints on the connector. Resoldering may be all that is required to effect a repair, in this case.

To illustrate the principles discussed above, measurements were made on some real wall-warts and are given in **Table 1**. The unit of **Photo B** is a battery charger for a hand-held radio; its output is unfiltered, as the oscilloscope display of **Photo C** clearly shows. This is typically the case for chargers, as contrasted with power supplies, which do often contain the filter capacitor. A charger may also contain current-regulating circuitry, but often they are no more than a simple DC unfiltered supply, like this one. To see the contrast, **Photo D** shows the nearly pure DC output of a filtered supply, the MW1250. This waveform is with no load; however, some ripple would be evident under load.

Notice how much the voltage varies between the no-load and the full-load condition for the power supplies of **Table 1** that include a capacitor filter. In fact, the power-supply voltage rating for DC supplies is not very precise at all. Keep this in mind if you are selecting a wall-wart as a replacement or as a power supply for a project you're building: The labeled voltage is very approximate, unless a voltage regulator is included. Make sure that your equipment can handle the possible range. Finally, also notice in **Table 1** that the primary (input) resistance is considerably lower for the higher-power units.

At least a brief mention should be made about connectors often used with wall-warts. See **Photo E** for some typical connectors used. The most popular style is a hollow "barrel" connector (also known as a "coaxial" power connector), as shown in the leftmost two units of **Photo E**. Both

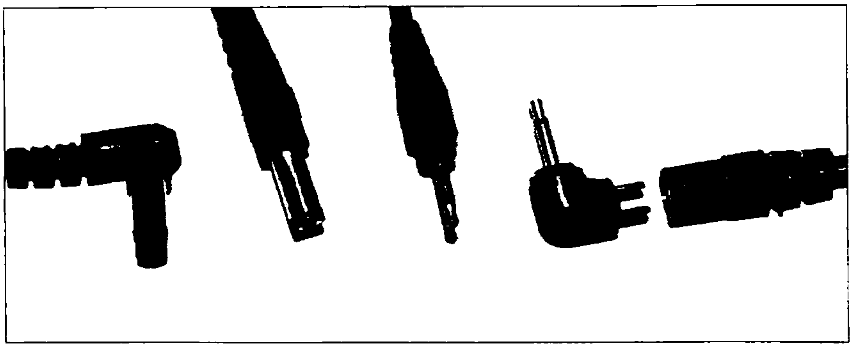

Photo E. Typical wall-wart output connectors. The two units to the left are "barrel" types. The next style is a 2.5mm subminiature phone plug. The unit shown on the right is a 2.5mm plug provided on a reversible-polarity adapter to the wall-wart.

Outer diameter — mm (in.)	x	Inner diameter — mm (in.)
2.5 (0.098)	x	0.75 (0.030)
3.0 (0.118)	x	1.0 (0.039)
3.5 (0.138)	x	1.35 (0.053)
4.0 (0.157)	x	1.70 (0.067)
5.0 (0.197)	x	2.10 (0.083)
5.0 (0.197)	x	2.50 (0.098)
5.5 (0.217)	x	2.10 (0.083)
5.5 (0.217)	x	2.50 (0.098)

Table 2. Common hollow-barrel connector sizes.

the outer diameter of the plug barrel and the inner diameter (of its hole) must be matched when replacing. You'll find that 5.0mm x 2.1mm is a common size for amateur accessory equipment. The dimensions may be specified in decimal inches for some replacement units, but metric is more common. The most accurate way to measure the outer diameter is by using a vernier caliper or a micrometer, though careful use of a metric ruler may be workable for the larger sizes. The inner diameter is trickier to determine, since it's recessed and so small. A technique I've found useful is to use the shaft end of small drill bits to gauge the inner size. A 3/32" bit is 0.093" decimal or 2.38mm; 5/64" is 0.078" decimal or 1.98mm; and 1/16" is 0.0625" decimal or 1.59mm. By estimating the looseness of fit, generally the standard metric diameter can be determined. Numbered drill bits and solid bare copper wires are other useful probing devices, and provide other sizes. **Table 2** lists some common standard sizes used with these barrel connectors. There are others, of course.

Remember that with DC supplies, using correct polarity is critical. These connectors may be installed with either polarity — sometimes the inner conductor is positive, sometimes it's negative. The wall-wart labels usually state the polarity used.

Miniature phone plugs are sometimes used on wall-warts. These look just like standard earphone plugs. The two standard sizes are "miniature" (3.5mm in diameter, sometimes quoted as 1/8") and "subminiature" (2.5mm in diameter and sometimes stated as 3/32"). A subminiature connector is shown in **Photo E**. Again, DC polarity must be matched, but it's much more common to find the tip positive with these plugs.

Because of the proliferation of different supplies and connectors, some vendors now provide replacement wall-warts with a reversible two-pin intermediate plug that is intended to be used with an adapter that terminates with the connector needed on the equipment. Such a device is shown in the right of **Photo E**, terminating in a subminiature plug in this case. You replace a faulty supply in three steps using this scheme: (1) select the wall-wart to match the electrical requirements of your equipment; (2) select the adapter that mates with your equipment's power connector; (3) properly orient the adapter onto the two-pin supply connector to provide the proper DC polarity to the equipment.

Of course, there's the occasional oddball proprietary connector to deal with. Here, your only choices are to purchase an exact-replacement supply from the original manufacturer, or to cut off the original connector and splice its leads into the output leads of a replacement. DC polarity will probably have to be matched by testing with a voltmeter, if the latter approach is taken.

Hopefully the information presented in this article can help you troubleshoot a suspected wall-wart power-supply failure to determine the actual cause, and repair it if possible. If necessary to replace it, a good understanding of the different power-supply types and characteristics should make selecting a suitable replacement straightforward. As reference to **Table 1** indicates, the label of a wall-wart gives only approximate values, so remember to make proper measurements to confirm the actual ratings of a possible substitute replacement.

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Return of the Wavemeter

Nostalgia? Fun project? Or both?

Wavemeters date back to almost the beginning of time, or at least it seems that way. They at least date back to the first "receiver" that was used to detect a spark from the first known transmitter.

Although ancient in years of use, the wavemeter was the staple of ham radio test equipment up until the time frequency counters became affordable. Although superseded by counters, the wavemeter is still an important and inexpensive piece of test equipment that shouldn't be ignored.

A wavemeter is an independent resonant circuit that can be used to verify the band at frequencies upon which a transmitter is operating. Being independent, it can be counted upon to provide accurate results, or a "second opinion" in case of a general frequency or band dispute.

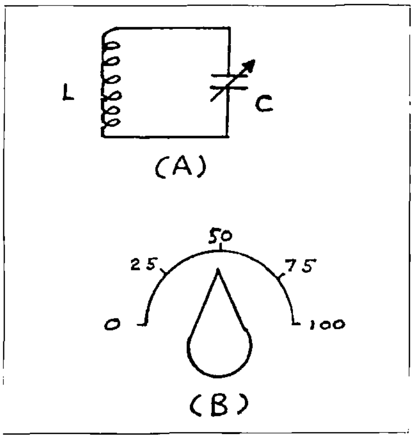

Fig. 1. *(a) Basic circuit of a wavemeter. Values for L and C are selected for resonance at the desired band of frequencies. (b) Typical knob and dial used with a wavemeter. Dial is normally calibrated in increments of frequency.*

Wavemeters come in many forms, with a few selected types being discussed here, but each performs a similar function — resonates at a given frequency.

Any resonant circuit may be used as a wavemeter to "measure" the band of frequencies upon which a signal is being generated. When coupled to a signal source, it will absorb RF energy at the frequency of resonance. Being a "linear" device, it will not resonate on harmonics of a fundamental signal, unless the fundamental signal is loaded with harmonic energy. Nor will it distort a signal causing the wavemeter to indicate an erroneous frequency.

As a ham, why would you be interested in using or having a wavemeter available? The answer is best left to you as a ham experimenter. However, wavemeters are a "basic" tool that can be used for determining a band of frequencies upon which a signal is being generated. Suppose that you do not have a counter available and you've just built up an oscillator and buffer amplifier. How will you determine the band of frequencies upon which it is operating? You'll need some kind of a detector and a frequency band reference measurement. Of course, if the oscillator is crystal-controlled, you'll know the frequency and the multiplication factors for the desired harmonics. But on which harmonic is the circuit tuned? A wavemeter comes to the rescue because it will respond only to the dominant output harmonic that the circuit is producing.

As you can see from the above example, a counter would probably give you the frequency, and accurately too, but sometimes the counter can become confused when there is too much harmonic energy in the signal or if the

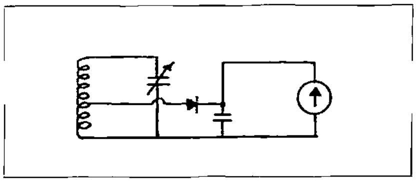

Fig. 2. *Wavemeter utilizing a diode detector and a meter to indicate circuit resonance.*

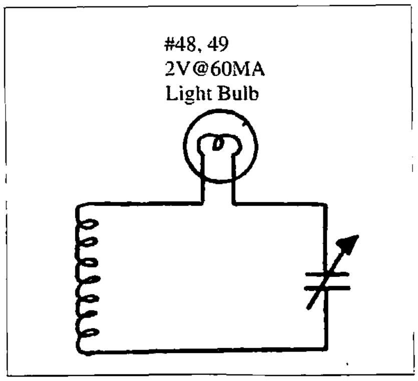

Fig. 3. One of the earliest methods used for indicating resonance of a wavemeter was to employ a light bulb. The bulb's glow was dependent upon the circulating current flow.

level is incompatible with the counter's input circuit. Again, the wavemeter to the rescue as it will pick out the most predominant signal amplitude. The wavemeter provides a second opinion, so to speak, and provides confidence in one's judgment. A wavemeter is a passive resonator and will always "display" the correct band or frequencies should there ever be a question.

Wavemeters come in just about any package and mechanical size that you might consider. An old grid dip oscillator makes a really nice wavemeter when the oscillator has been turned off — and comes with calibration marks, too! There is no limitation to the frequency band where a wavemeter may be operated. Remember, it is only a resonant circuit with the elements tuned to the desired band of frequencies. The basic circuit is shown in **Fig. 1,** and it applies to all wavemeters regardless of size, shape, or material. Also shown in **Fig. 1** is a typical dial that is attached to the wavemeter that can be marked off in increments of frequency.

In use

When a wavemeter is used, it is brought near an active circuit that is to be checked. When tuned to the same frequency as the circuit being tested, energy will be absorbed by the wavemeter and the calibrated pointer will indicate the approximate frequency of the signal being measured.

Sometimes it is difficult to mechanically place the resonant circuit close to the circuit being tested. When that happens, a long coupling link or a short length of coax with a 1–5 turn pickup loop on both ends may be used to couple energy from the circuit being tested into the wavemeter. The caveat of using the coax is that it too can become resonant and create a false frequency indication. Care must be taken to avoid that possibility.

To obtain an indication of energy being absorbed, one of several techniques may be employed. The easiest method is to attach a diode detector to the wavemeter and allow the detected signal current to operate a meter (see **Fig. 2**). The meter will indicate an increase in diode current based upon resonance and the strength of the detected signal. The completed circuit is essentially the same as a field strength meter except that an antenna is not used — although an antenna may be added.

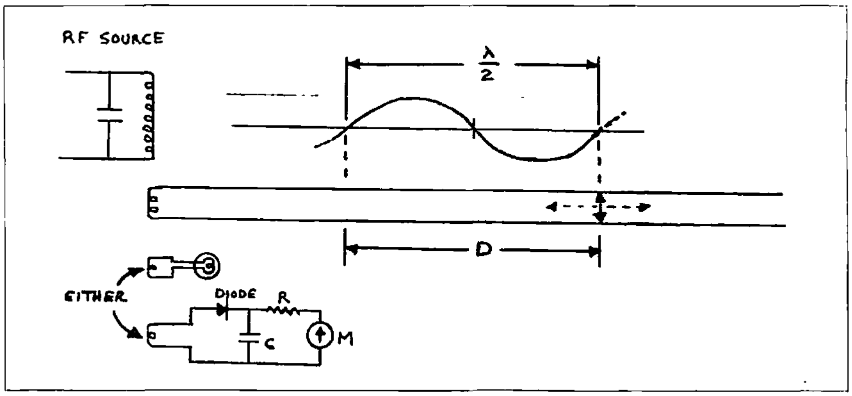

Fig. 4. Lecher Wire system used for determining the relative frequency of a signal source. Detection of the signal null may be done using either a light bulb or a field strength meter. The detector circuit is located on the opposite side of the Lecher Wire pickup loop in order to create the greatest amount of field amplitude change. D in meters: F(MHz) = 150/D. D in inches: F(MHz) = 5905/D.

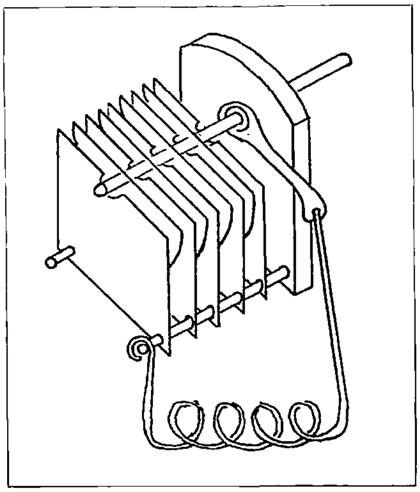

Fig. 5. A coil and variable capacitor connected to form a resonant circuit to be used as a wavemeter. A pointer knob may be mounted on the capacitor's shaft. A calibrated frequency scale may be mounted on the capacitor's mounting plate.

Another method is to detect the signal absorption in the circuit being tested. There is usually some form of metering within the circuit that will indicate when energy is being absorbed from that circuit.

One of the early indication methods used was to place a low current dial light in series with the coil and capacitor (see **Fig. 3**). The light bulb would glow based upon the magnitude of the circulating current within the resonant circuit. In use, the coupling was the least amount necessary allowing the lamp to glow dimly.

Lecher Wires

Perhaps the next oldest wavemeter is the Lecher Wire system shown in **Fig. 4**. It works on the same principle as a coil and capacitor absorption wavemeter except that it is a section of open wire transmission line having a length exceeding about two wavelengths at the anticipated frequency of operation. 300-ohm TV twinlead works well in this application even with the insulation remaining on the wire.

A transmission line is a system of

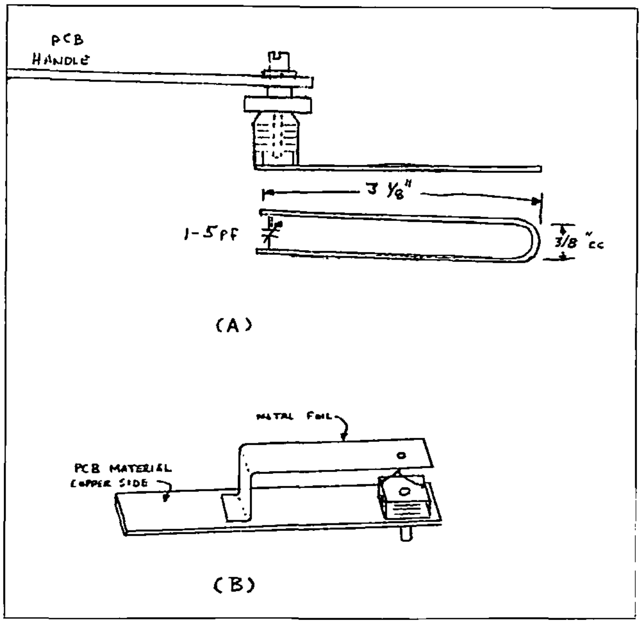

Fig. 6. VHF/UHF wavemeters: (a) Horseshoe resonators made from heavy copper wire (#10-#14) with dimensions shown for the 450 MHz band. (b) Horseshoe resonator made with metal foil mounted on a piece of printed circuit board material.

distributed inductance and capacitance, while the basic wavemeter is lumped inductance and capacitance. The two systems perform the same regardless of their mechanical configuration differences.

One of the advantages of the Lecher Wire system is that it can be utilized well up into the microwave region, though a little tough to use at short wavelengths. Typically, when operating in the microwave region, it is better to shift the configuration to waveguide where small mechanical dimensional changes can be observed/measured more accurately.

Normally, energy on a transmission line is traveling from the source to the load and standing waves on the line are not desirable. In the case of a Lecher Wire system, a short is deliberately placed across the wires to create standing waves. A shorting bar placed across the line is moved along the line creating distinct peaks and nulls (standing waves) on the line. When using TV twinlead, a screwdriver shaft laid across the line functions well as a "short."

By measuring the distance between half-wave length peaks or nulls on the line, one can determine the approximate frequency of operation. Actually, frequency of operation can be determined rather

Continued on page 22

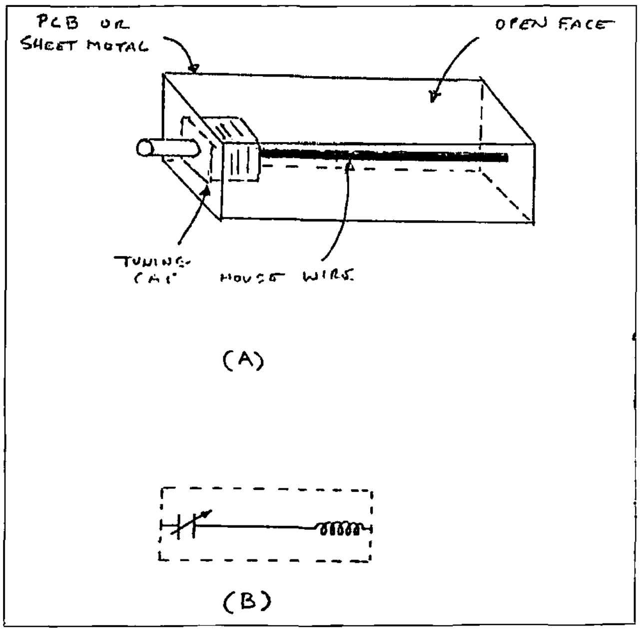

Fig. 7. Pictorial view of a channel resonator used as a wavemeter. (a) A straight wire resonator allowing the circuit to resonate at the highest frequency. (b) A coil may be added to the cold end of the resonator to lower the frequency of a given channel. Notes: Box length contributes to operational frequency. Line length and cap value determine frequency.

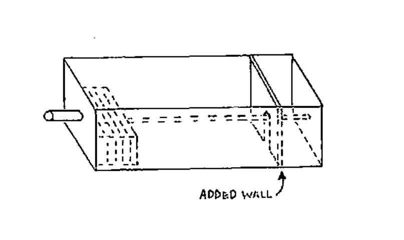

Fig. 8. Channel resonator with an added wall used to shorten up the channel length with the intention of raising the frequency of resonance. The wall must be soldered to the wall and resonator wire to maintain stability.

accurately with Lecher Wires. The equations for determining frequency are shown in **Fig. 4,** with measurements taken in either inches or meters.

Detecting the absorption of energy at the half-wave points can be done in several ways as shown in **Fig. 4,** with the metering technique being the most sensitive. The light bulb technique is perhaps the oldest method used and is effective as long as the signal source generates sufficient energy to light the lamp to a minor brilliance.

Coil and capacitor

The easiest wavemeter to build is one where a coil and capacitor are connected as shown in **Fig. 5**. The table shown provides typical inductance and capacitance values suitable for the various ham bands from 160 meters through 450 MHz.

Mechanical construction of the wavemeter is based primarily upon the selection of a capacitor. The simplest mounting for the capacitor is to fashion a handle using a wooden paddle or a short section of printed circuit board material.

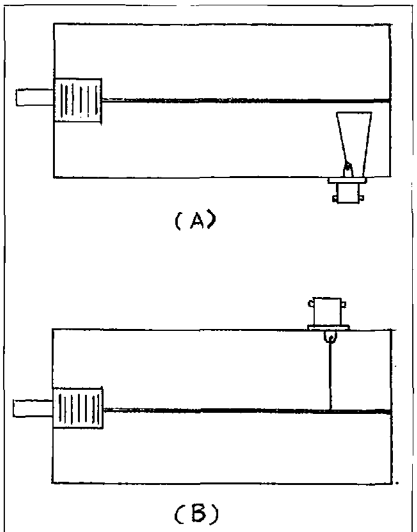

*Fig. 9. Methods for adding a coupling link to a channel resonator. **(a)** Link is coupled to the side of the resonator and is positioned for a desired coupling factor. **(b)** Link is tapped directly on to the resonator. Tap is positioned for a desired coupling factor and impedance value.*

Horseshoe resonator

When operating above about 2 meters, the lumped inductance of a coil becomes small enough such that it becomes mechanically easier to form the inductor into a loop like a horseshoe. The actual circuit then becomes a combination of distributed inductance and capacitance connected to a lumped capacitance. The horseshoe configuration is usable at frequencies from 2 meters up to perhaps 900 MHz. At the higher frequency end, the lumped capacitance begins to hinder the desired operation and shifting to microwave techniques is preferred.

Fig. 6a shows a typical loop soldered to a variable capacitor for use in the 400-500 MHz band. The loop is made of #12–#14 copper house wire, and may be used with or without insulation on the wire. The use of insulation will prevent the loop from actually making electrical contact with the circuit being tested.

Fig. 6b is another form of the horseshoe. In this case, the variable capacitor is mounted onto a section of printed circuit board. The loop portion is a strip of copper or any solderable material that is formed to create a loop as shown. The frequency coverage of this configuration can essentially be from 2 meters to 900 MHz. The frequency of operation is dependent upon the capacitance value and the length of the "loop."

Channel resonator

The channel resonator is an interesting wavemeter because of the construction as shown in **Fig. 7**. It is an adaptation of a quarter-wave coaxial resonator. Depending upon the resonant line that's used, the channel can be resonated from about 6 meters up to 900 MHz. Electrically, the length of the wire line is equal to a quarter-wavelength at the operating frequency. Physically, the mechanical length is much shorter and is controlled by the lumped capacitance and the length of the channel. The actual tuning bandwidth for a single resonant line (channel) is limited to perhaps one or two bands such as 220-450 MHz.

F (MHz)	C (pF)	L (µH)
2	175	40
4	90	18
7	50	11
10	35	7
14	26	5.5
17	21	4.5
21	17	3.5
29	13	2.6
51	7	1.4
146	2.6	0.7
222	1.6	0.35
445	0.08	0.17

Table 1. Approximate values of capacitance and inductance shown for resonance of a tuned circuit for each of the ham bands indicated.

Construction of the channel resonator is simple. A variable capacitor is mounted at one end of the box and with a wire, or coil, connected between the capacitor and the opposite end of the box. The box material has a metal interior with one broad side left open. Printed circuit board material is easily worked and can be soldered on the inside to form a metal box. The exterior may or may not have copper, as the circuit is dependent only upon the interior metal wall. Yes, an aluminum box will work as long as one side is left open for a wavemeter application.

Fig. 8 shows a simple technique for changing the band of frequencies covered by the device. Adding a movable wall on the far end of the wire line, the frequency of operation can be increased. For the frequency response to

remain stable, the wall and center wire must be soldered in-place because the circuit is dependent upon the circulating current path within the walls of the box and the wire.

Coupling to the channel resonator is done by holding the open side of the box close to the circuit being tested. Should the close proximity of the box to the circuit become cumbersome, an alternate coupling method may be employed.

Fig. 9 shows how a coax connector may be mounted in one wall of the box or at one end to provide coupling access. A wire loop is placed in close proximity to the resonator and is used for coupling a signal into the resonator. A loop (link) of wire may be used as shown in **Fig. 9a** when the connector is mounted in the wall.

Moving the loop closer or farther way from the center wire will control the amount of signal coupling.

As an alternative coupling method, a connector may be mounted on the side of the box as shown in **Fig. 9b** with a direct tap to the resonator wire. The amount of coupling is controlled by the placement of the tap onto the center wire. The link position should not be placed higher than about 1/4 the length of the wire up from the "cold" end. The matching impedance at the approximate 1/4 position is near 50 ohms and will be less as the tap position is moved toward the "cold" end.

Conclusion

Even though wavemeters have been around for a great many years and come in a wide variety of shapes and sizes, they are still a great standby piece of test equipment. A ham who experiments with circuits should always have a wavemeter available for that "one time" when it is most needed.

Please build up a wavemeter or two and experiment with them. In doing so, you'll develop an appreciation for what they can do for you.

Say You Saw It In *73!*

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Your Long-Lost Transistor Notebook

Part 2 of 4.

Part one of this series discussed some of the reasons why an experimenter should look beyond prepared circuit designs and look into how circuit values are established. Doing a little experimentation with transistors obtained from the "junk box" can provide a wealth of knowledge and an understanding of them.

Characteristic curves representing how a transistor responds electrically provides us with a desirable tool for determining how circuit values can be established for operating a transistor in a circuit. Since sets of characteristic curves on specific transistors are not generally available, the ham experimenter may choose to generate his own set of curves and build a data file for transistors found in his "junk box." Using that data file, the ham will be able to work out circuit values including resistor values, signal amplitude limits, linearity, input/output impedance, stage gain, etc.

Ib = ____	
Vce	**Ic**
0.5	
1.0	
5.0	
10	
15	
25	

Table 1. Suggested table used for collecting test data. A separate table is required for each base current value to be examined.

Part one left off with the suggestion for gathering together all of the transistors in your "junk box" and setting up a test for collecting data on how they react to a test stimulus. With the data collected in a table format, it can then be transferred to graph paper, where curves are plotted; these curves are called Vce-Ic characteristic curves.

Plotting the curves

Graph paper with a linear layout format is preferred over other formats. The size of the graph division is not critical and a common quadrille pad works well for this application. The first step in the process is to lay out and mark off the vertical and horizontal axes in the desired steps. It is recommended that the step increment between numbers be equal to create a linear axis.

A pencil is used to place marks on the graph paper that correspond to the data points obtained from the table shown in **Table 1** (carried over from Part 1). Plotting two or more points around the knee establish the general shape of the knee and the beginning of the slope toward the higher Vce values. Plotting one or two points between the top of the knee and the highest Vce value will establish the slope for the curve and, for most, it will be a straight line as shown by the example in **Fig. 1**.

I suggest plotting from five to ten base current curves in order to obtain a complete and more accurate profile of a transistor's response.

Characteristic curves

Once the curves are plotted, it is then necessary to use the set of curves as a tool. The plotted curves represent

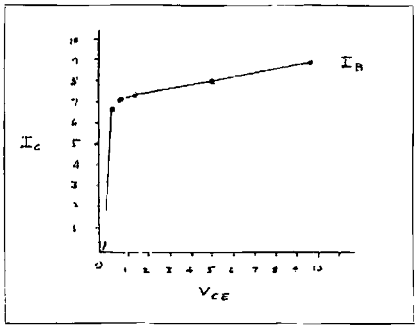

***Fig. 1.** Example of how several points are plotted to establish a base current curve. A minimum of three points are plotted to define the knee of the curve and two or more points to define the straight portion of the curve.*

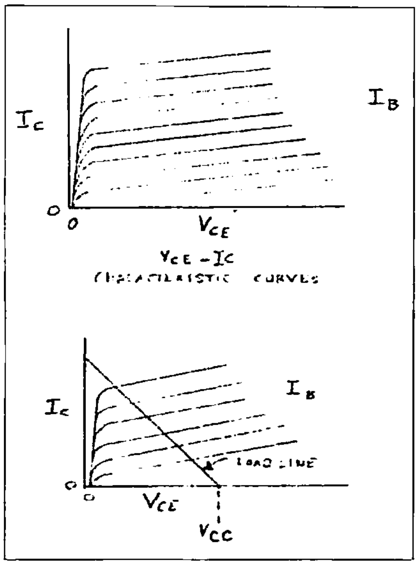

Fig. 2. Load line laid out on a set of characteristic curves. Coordinates for the load line are at the maximum Ic value and the applied Vcc voltage value.

the transistor's reactive response to how it will perform in a circuit, and as a result the curves are called characteristic curves.

To use the curves, it is necessary to set up a set of desired conditions under which the transistor is expected to function. The conditions first include the power supply voltage (Vcc) that will be used to power the circuit. The second is the maximum amount of current that you would like the transistor to handle; though it may never reach that specific value under normal operating conditions.

The steps involve locating the Vcc value along the Vce axis and then locating the desired maximum Ic on the vertical axis. With those two points marked with a pencil, use a straight edge and draw a line between those two points as shown in **Fig. 2**.

The straight line just drawn is called a "load line" and represents the path along which the transistor will travel while being used in the circuit. Consider the transistor as being on a short leash and being tied to a long clothesline such that it can move freely along the line from end to end. But with the leash, it can move only along the line and not away from the line. In other words, the load line establishes the operating path over which the transistor can function, and it will function only as its characteristics will allow. For Class-A audio applications, the transistor would typically operate at about the mid-point along the load line. In most cases, a linear transistor response occurs near the center portion of the load line.

Transfer curve

But to determine how the transistor is going to respond and to verify a linear response, another curve must be drawn which is called a "dynamic transfer characteristic curve" (see **Fig. 3**).

Although a transfer curve appears to

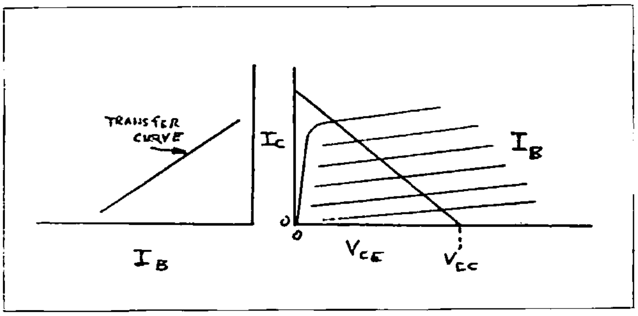

Fig. 3. A dynamic transfer characteristic curve is shown on the left. The transfer curve shows the linearity of the amplifier's response to an input signal where a straight line is preferred. Any curvature in the transfer curve indicates amplitude distortion.

be a duplicate of the load line, it isn't the same in that it follows the actual response of the transistor based upon the characteristic curves. That means it can be curved indicating a non-linear response, or straight indicating a linear response.

Let me tell you a short story about why hi-fi amplifiers became known for having "high power" when only a very low power is actually required for listening pleasure — that's my opinion! Anyway, linearity was the key issue involved, as can be seen in **Fig. 4**, where two "curved" examples are shown. Let's take, as an example, an amplifier capable of producing one watt of audio output. If we desire to obtain a full one watt of linear audio response, the transfer curve would have to be absolutely straight over its entire length. There is no guarantee that the transfer curve is going to be straight over its full length, so the resulting audio from our example would most likely exhibit distortion at the highest audio levels. If you examine the transfer curves shown in. **Fig. 4**, you will note that a very short section at any point along the curve appears to be straight.

Therefore, the solution for achieving a "linear response" from an amplifier has been to raise the available power to, say 100 W, and then operate the amplifier at the one watt level, where the transfer curve shows the response to be essentially linear. In most circuit applications, seldom do we have the luxury of increasing the power for the purpose of improving response linearity. As a result, we need to examine the transfer curve for each device application and make some choices in the resulting design to achieve a desired response.

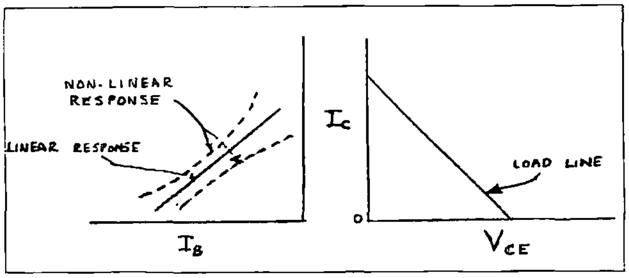

Fig. 4. Examples shown on the left of linear and non-linear transfer curves.

Following the example that's shown in **Fig. 5**, you can develop a dynamic transfer curve. A section of graph paper is placed to the left of the Vce-Ic characteristic curves where a load line has been drawn. Coordinates for the transfer curve use the same Ic and Ib increments that were used for plotting the characteristic curves, with the horizontal axis of the transfer curve being the Ib axis. It is important to have equal spacing between the Ib increments to ensure a linear scale factor.

A pencil dot is placed along the load line that corresponds to the intersection between the load line and the base current curve. As shown in **Fig. 5**, a dot on the load line is then transferred to the left until it corresponds to the same base current value as that on the load line.

With all of the transferred dots in place, hold the graph such that you can sight along the dots to view any possible curvature. Then, connect the dots with a pencil line and then sight along it again. I recommend drawing the line freehand rather than with a straight edge, because the use of a straight edge could mask a line curvature.

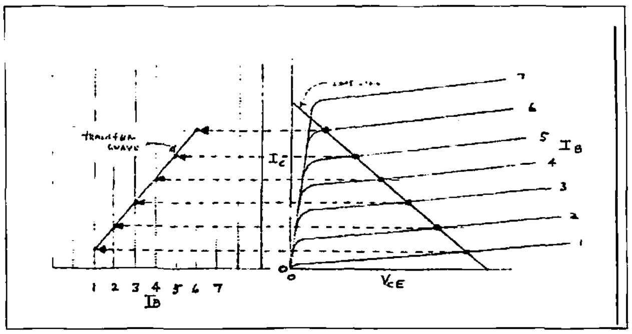

Fig. 5. Plotting the transfer curve. Load like intersection points are extended to the left and plotted against a liner Ib scale.

Let's stop here for a moment and summarize where we are on this tour. We've run tests on a transistor and have plotted a set of characteristic curves from the test data collected. Using the curves, we chose a Vcc and maximum Ic to establish load line coordinates. Using the load line, we then plotted a dynamic transfer characteristic curve and checked it for linearity.

Now, what does all of this mean to us? First, we've developed a set of tools that will allow us to examine the transistor in advance of a hardware project and will now be able to predict several things about the performance. The dynamic transfer characteristic curve is perhaps the most important tool, because from it we can now begin to develop circuit values. In Part 3 of this series, we'll set up a typical circuit application. Using the transfer curve, we'll work out the resistor values that support a Class-A linear amplifier response. In addition, the curve sets will provide us the tool for finding input/output impedance, circuit gain, amplifier response linearity, etc. In other words, all of the circuit parameters that you've been wondering about will now be able to be found. 73

73 Review

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Surplus Find: Easy Setup Portable HF Antenna

The Telex 1990 — aka AS-2259 man-pack antenna — can be a treat for amateurs.

Hams are always looking for two very important things to operate portable HF. One is a usable, transportable power source; the other is a very easy-to-install antenna that covers all the HF bands. Here's the story of my search for the second.

Some operating locations do not have tall trees or other structures from which to hang a dipole or longwire. In keeping with the KISS principle, if you have a need it was probably done before, so look at what other people have done about this. Looking at some catalogs from Telex/Hy-Gain and Fair Radio Sales, I noticed the answer to my desires. Our Armed Forces are great users of radios, whether HF, VHF, or UHF. They have antennas for every situation, and then some. One antenna stands out: the AS-2259 man-pack antenna. It is easy to use and set up, fairly portable, handles up to 1kW, and is affordable via the surplus marketplace. This antenna is manufactured by Telex, and has the model number of 1990. (See **Photo A.**)

Operation and use

The Telex/Hy-Gain product literature calls it the "Near Vertical Incidence Skywave Antenna." In amateur terms, this is a high angle antenna, perfect for local communications within a 400 mile radius. The antenna has a 15-foot mast section which serves as the antenna coaxial line. The antenna has 4 wires: 2 on ground, and 2 on the center conductor. The wires are terminated to plastic insulators going to rope supports, and then ground pegs to secure the antenna structure.

The antenna was made to be set up by 2 people in less than 5 minutes. One person will have no trouble setting up this antenna in a few minutes. He unrolls the wire antenna, spreads the 4 wires equally, and then secures his pegs into the ground. Now he can assemble the mast section, by inserting each coaxial pipe into the bottom of the next. When the mast is complete, he rechecks each wire and the supporting rope. Then he eliminates slack, by tightening the length of the supporting rope or moving the ground peg.

This antenna was designed to be used with the PRC-47 man-pack transceiver that covers 2 to 12 MHz. The antenna mast was mounted right on the radio, with an adapter.

However, we nonmilitary personnel

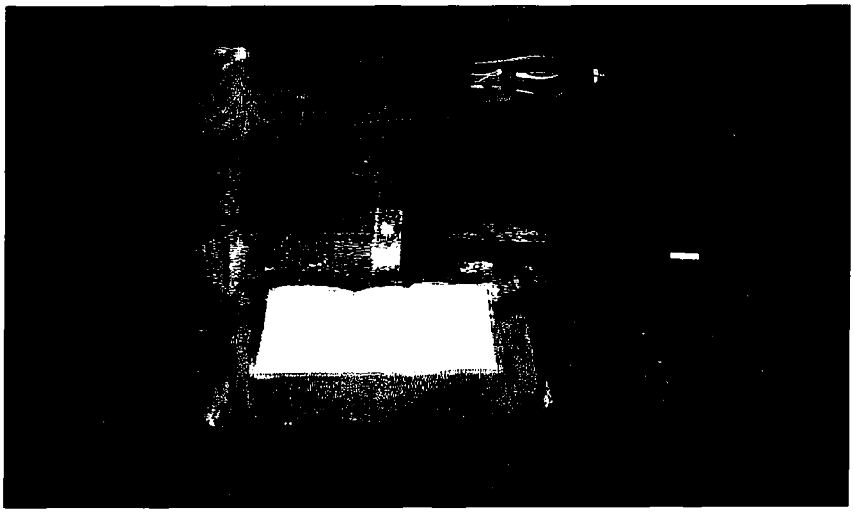

***Photo A.** Easy setup portable HF antenna.*

Photo B. I placed an SO-239 female connector on the box, with inside wiring going to the ground and center conductor.

have just one problem with this antenna: The coaxial pipes that make up the mast sections have no easy way of attaching to our coax cable. The military and Telex/Hy-Gain have two types of mounting ground bases (the model 1994, and the model 1995, which has it own 4:1 transformer and only handles 50 watts). These mounting bases are hard to find on the surplus market, and very expensive if bought directly from Telex/Hy-Gain.

Please don't get me wrong: Telex military products are excellent and well designed, and will last a lifetime.

It's just that we amateurs don't have the same deep pockets as our government, whose vaults are lined with our hard-earned tax dollars.

You may wish to do the coax mounting with two alligator clips, ground to ground, center conductor to center conductor. Just be careful not to short the two together, or have the center conductor touch the ground.

Another mounting scheme I tried was to make another coaxial pipe section with a copper tube center, insulating the center tubing and then mounting a circular flange near the bottom end. I then used a metal box that supported the flange and coaxial antenna. I placed an SO-239 female connector on the box, with inside wiring going to the ground and center conductor (**Photo B**).

Other persons might want to make the metal box a little bit bigger to mount a tuning network. Most hams who use this antenna have mounted the bottom section to a 2" x 4" piece of wood, soldering the coax directly to the center pin, and using a metal self tapping screw with a lug for the ground connection.

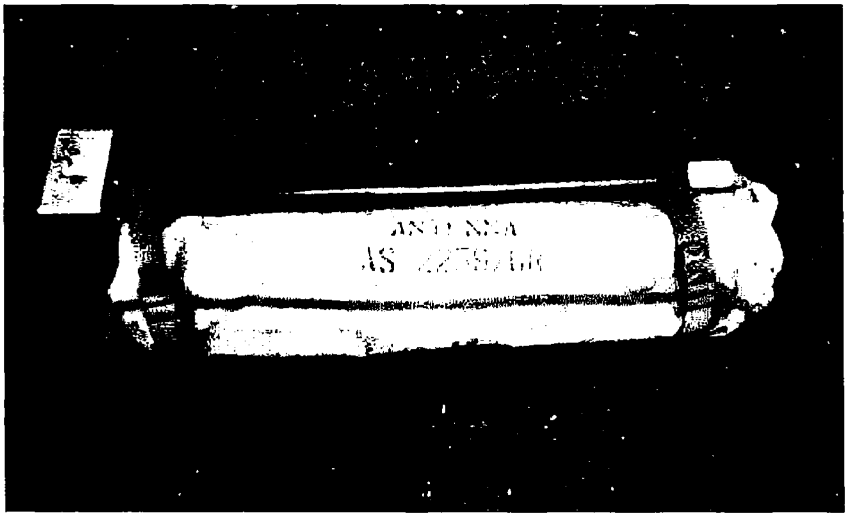

Photo C. The antenna weighs about 16 pounds, and is a compact 6" x 6" x 26" when packaged and rolled up.

The antenna is designed to have vertical and horizontal polarization. Its radiation pattern is omnidirectional. Many operators have found that this antenna is useful when contacting stations within 400 miles.

The antenna is packaged in a canvas roll bag that neatly carries everything. It weighs about 16 pounds, and is a compact 6" x 6" x 26" when packaged and rolled up. (Please refer to **Photo C**.) Using an antenna tuner, this antenna tunes from 3.5 to 30 MHz very easily. Most people who use NVIS antennas use them below 15 MHz, where the strength of their signal is higher. There were no bands that had a high SWR.

With today's automatic antenna tuners, this antenna will not present any problems. As an added bonus, the mast section can be also used to support a small VHF/UHF ground plane antenna. It's best to use a nonconductive material, to support the antenna onto the side of the mast.

The antenna was used in past Field Days, special events, etc. It is ideal for Field Day, where most of the low angle antennas are great for DX, but the NVIS is ideal for all the local stations within a 400 mile radius. Who else has something that is easy to put up, store, and transport, is easy to use, and has a low cost on the surplus market.

Internet sources

A very interesting Web site that has a NVIS section is: [http://www.tactical-link.com].

For those with Internet access, here are a few sites and news groups where you could look for military equipment. This is in no way a complete list. Many sell equipment of military nature in the "rec.amateur.boatanchors" newsgroup. Sometimes we see a military antenna of some sort in "rec.amateur.antennas." There are some Web pages that have military radios, and a dedicated mail reflector just for military equipment. Using your Web browser, check out [www.qth.net], and subscribe under the "milsurplus" group.

Alf Coupe VK3CQE
5 Finch St.
Beechworth, Victoria 3747
Australia

John Wilson VK3LM
RMB 4201A
Tallangatta Valley, Victoria 3700
Australia
[johnvklm@mpx.com.au]

Farrell Winder W8ZCF
6686 Hitching Post Lane
Cincinnati OH 45239
[fwinder@one.net]

"Back later today, dear. I'll be at tomorrow's hamfest in Australia ..."

Here's a special report about the Twin Cities Radio and Electronics Club, Inc.'s Year 2000 hamfest held in the city of Albury, NSW, Australia.

Through the ingenuity of Alf VK3CQE and John VK3LM, everything was arranged so that W8ZCF in Cincinnati, OH, USA, could view many "live" scenes with pictures and sound from the Twin Cities Hamfest in Albury, NSW, Australia, which occurred on August 13th, 2000. Voice and pictures were made possible by utilizing VocalTec IPhone 4.5, an Internet voice-video software program. We believe a first may have been accomplished in this regard in connection with amateur radio hamfests.

Background

W8ZCF made acquaintances with Alf VK3CQE and John VK3LM through a mutual friend, Don Miller W9NTP of Waldron, Indiana. W9NTP and his wife Sue W9YL (now a silent key), had toured Australia by motor van, operating mobile under the call VK2IKZ/M. They had circled much of the coastal area of Australia during an 8-week tour beginning in September 1997. During this period, due to band conditions, Don could seldom be heard direct in Ohio, USA.

Photo A. Alf Coupe VK3CQE, first picture received by W8ZCF of Albury Hamfest.

VK3LM acted as a relay via 20 meters to send Don's 80m and 20m SSTV pictures to W8ZCF. During this time, contact was also made with Alf, and SSTV exchanges have continued between these stations over the last 2 years. Many excellent, often "studio-quality," pictures of the people and landscapes of the two continents have been exchanged on 20m SSTV.

A few months ago, Alf and Farrell began to experiment with PalTalk, a voice/video computer Internet software system. They were able to attain only a partial success, with one-way excellent audio from Australia, but the return from the USA had to be via the keyboard. Alf, being the experimenter and "wizard" for which he is nicknamed, suggested a try be made with VocalTec, another voice video system. Assisted by 20 meter contacts to set up and make adjustments between the two stations, VocalTec IPhone 4.5 has been, most of the time, very successful. Exchange of "live" moving pictures on a once-a-week schedule has been maintained over several weeks. Pictures sent by both stations are 320 x 240 resolution, which produces about a 9 x12 cm picture on a 17-inch monitor set for 800 x 600 pixels. In the program there is also a provision for sending very high resolution still pictures through a "whiteboard." These pictures transmit very quickly, in a matter of seconds to

Photo B. Farrell Winder W8ZCF, typical of picture received at Albury Hamfest from Cincinnati, Ohio.

Photo C. Greg Sargent VK2EXA.

Photo D. Bruce Mitchell VK2AYM.

Photo E. Brian Dick VK2TGS.

Photo F. John Wilson VK3LM.

a minute depending on the actual resolution, and provide very excellent quality.

Invited to the Albury Hamfest

With the above success, Alf related that he and John VK3LM were going to do an SSTV demo at the Albury Hamfest on August 13, 2000, and that W8ZCF was invited to attend using the VocalTec experimental system.

Alf set a time, explaining that he would first shoot a series of Olympic Torch pictures from that morning as the runners proceeded down Ford Street in his village of Beechworth, Victoria. He would then race to Albury via automobile to set up for the schedule.

Success!

Alf completed his Olympic mission. Precisely on schedule at 01:00 UTC, 9:00 p.m. USA and 11:00 a.m. Australia time on August 13th, 2000, VK3CQE appeared live on W8ZCF's computer screen!! So with all the available high tech arrangements, it was possible to watch an August 13th show on August 12th!

Alf presented a series of shots at the hamfest using a small low resolution camera connected to his Packard Bell computer. The picture of Alf in **Photo A** is the first picture received in Ohio. Typical of pictures seen in Australia from Farrell is that one shown in **Photo B**. W8ZCF was using a Debco Computer with an inexpensive Intel PC Camera (ProPack Version).

The connection to Australia continued for almost two hours of picture and voice exchange with many attendees at the show who came by for a look at the experiment. The connection to the Internet was provided by Ross Wheeler VK2DGY, who owns and runs the Albury local Internet service provider. Ross gave free use of the Internet, and the arrangements for the hamfest experiment were made between himself and Greg Sargent VK2EXA of Albury. All of us involved wish to thank them very much for their generosity. Greg attended the show, and his picture as received in Cincinnati is shown in **Photo C**.

Many other visitors came by, QSO'd through Alf's setup, and made their TV debut! These included Bruce Mitchell VK2AYM from Lavington, NSW, shown in **Photo D**. It may be noted that Bruce has a "Boarding Kennels" operation as seen from the logo on his shirt. Brian Dick VK2TGS of Thurgonna, NSW, is shown in **Photo E**.

John Wilson VK3LM of Tallangatta Valley, Victoria, is shown in **Photo F**

Photo G. In Glanville VK3AQU.

Photo H. John Quarel VK3HJQ.

Photo I. Hayden, future ham.

Photo J. Alf Coupe VK3CQE, with Kodak DC 290.

Photo K. John Quarel VK3HJQ at computer, and John Wilson VK3LM.

Photo L. The computer/VocalTec IPhone setup.

holding an SSTV Interlace Box. This is a VK3LM design and was offered as a kit introduced at the show. The interface does not use a computer soundboard. (Details of this kit may be obtained by contacting John Wilson at [johnvklm@mpx.com.au].) To note how fast technical news can travel, combined with amateur radio, this picture was shown locally on 2m SSTV the next morning in a portion of the Ohio/Indiana/Kentucky, USA, area. There was immediate interest by two chaps. It was later in the day transmitted via 20 meters to Don W9NTP/7, who was mobile near Winslow AZ. Don also expressed much interest in VK3LM's development.

VK3AQU, In Glenville of Myrtleford, Victoria, is shown in **Photo G**. **Photo H** is of John Quarel VK3HJQ from Tallangatta, Victoria. Note the small toddler in this picture who has come for an early introduction to hamfest activities. **Photo I** is of "Hayden," perhaps a future ham operator. He seemed to prefer a close-up shot, perhaps trying to get as close to the USA as possible!

Photo J is of Alf with his Kodak DC 290 digital camera, preparing to take **Photos K** and **L.** After the pictures were taken they were sent via the "whiteboard" as explained in the above text. This photo shows John's and Alf's booth, with VK3HJQ posing for a picture. (See the copy of the actual "live" picture which was received as **Photo H**.) VK3HJQ is again shown in **Photo L**, along with the VocalTec IPhone setup. The small "ball"-shaped camera on top of the computer monitor produced Photos A through J, which were received in Cincinnati, OH. Alf's Packard Bell computer and the microphone used to converse with W8ZCF are shown to the right of the monitor.

For "amateur" performance, we believe this experiment in showing live pictures from one side of the earth to the other must be a "first" for amateur radio hamfests. It was very successful, leading to much fun and excitement for all the participants and observers. In fact, W8ZCF definitely had the feeling of actually being there!

In return for the Albury experiment, it might be possible to set up another experiment to transmit one of the "live" forums of the Dayton 2001 Hamvention to an Australian group, subject to an agreement with all concerned.

Those who might be interested in also experimenting with the VocalTec program may download it from ZL3TMB's Web site at: [http://www.qsl.net/zl3tmb]. It is currently a free program, but good for only 7 days. It may easily be refreshed by the procedure of downloading to a saved file, uninstalling at the expiration date, and then reinstalling from the file, making it good for another 7 days.

Also supplementing amateur radio activities in a very broadening aspect of the hobby is the inclusion of VocalTec installations into many repeater stations around the world. For example, such repeaters as ZL3TMB-R, Christchurch, New Zealand; G7WFM-R, Nottingham, England; K5WH-R Houston, Texas, USA; and many others are currently set up to operate on a very frequent basis. Experience with these repeaters has resulted in excellent, enjoyable "DX" contacts that, in communicating performance, is comparable to operating though local repeaters with local contacts. The concept of combining with programs such as VocalTec should serve to strengthen amateur radio activities and contacts around the world.

Dan Metzger K8JWR
6960 Streamview Dr.
Lambertville MI 48144-9758

Read All About It!

Part 9 of good stuff from The Hertzian Herald.

All about More Troubleshooting Tips; Unit Men, Part 1; and Unit Men, Part 2.

Here are ten more troubleshooting tips to add to the ones we have given you before. As before, send me your favorite tips, and we'll do another ten in a few more months.

1. When troubleshooting a printed circuit board, shine a light on the bottom and view the circuit from the top. This will let you see the circuit tracks and allow access to lead wires for your test clips.

2. Metal transistor cases and heatsink tabs are nearly always connected to the collector, and provide easy-to-probe spots for checking voltages.

3. If a confusing or noisy trace appears on the oscilloscope, switch the trigger source to AC LINE. If the trace stabilizes, the noise is AC-line related.

4. Solderless breadboards are often ruined by forcing thick leads from 1-watt resistors or big capacitors into them. Later, when an IC pin is inserted into the same hole, the contact is sprung and makes intermittent contact. Solder an inch of #22 wire to the ends of those fat leads to avoid damaging your $35 proto-board.

5. Flexing often causes 'scope probes and coaxial test leads to open-circuit at one end — but which end? Touch the center pin of the connector to an oscilloscope's vertical input or a DVM on AC-Volts. The intact end will pick up quite a bit of AC line noise; the broken end, almost none.

6. A wooden toothpick is useful for keeping PC-board holes clear of solder while heating them.

7. You say you need to measure a 30 meg resistor, but your DVM only goes up to 20 megs? First, measure a nominal 18 meg resistor (call it Ra), then place it in parallel with the unknown (Rx). The unknown can be calculated from the Product-Over-the-Difference formula: Rx = Ra x Rtot / (Ra – Rtot). For example, if Ra = 18.13 megs and Rtot = 11.47 megs, then Rx = 31.22 megs.

8. You can often determine power supply current without breaking any wires by measuring the peak-to-peak ripple voltage across a filter capacitor on a 'scope. Where t is the discharge time between charging pulses, calculate I = C x Vp-p / t. For example, if a 40-µF cap has 2 V p-p ripple and discharge time is 8 ms, I = 10 mA.

9. Is the zener conducting? Zener diodes above 8 V produce a white noise of 5 to 20 mV p-p when conducting. If a sensitive 'scope on AC coupling doesn't show the noise, it's a good bet the zener isn't conducting.

10. Of course you can check a silicon diode by looking for high resistance one way and low resistance the other way on an ohmmeter. But high-voltage diodes (above 1 kV) usually consist of several silicon diodes in series internally, so the forward voltage required to get the "low" reading will likely be higher than the ohmmeter's test voltage, and you'll get a high reading both ways. Use a 9 V battery in series with the meter on the DCV range to check HV diodes.

Unit Men, Part 1

In pre-industrial times there was little need for an exact system of measure. Barter was the rule: this pig for that stack of hay; my two dozen eggs for the use of your plow horse for an afternoon. Surprisingly, electrical measures were just this informal prior

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to about 1890: 100 Daniell cells in series for a 150-mile telegraph circuit using No. 11 iron wire was a common rule — no mention of volts or ohms.

Charles-Augustin de Coulomb (French) began the trend toward more exact electrical measurement in 1785, when he proved that the force between two electrostatically charged bodies varied inversely as the square of the distance between them: $F = Q1 \times Q2 / d^2$. The unit of charge (Q) was designated the coulomb (C) in his honor. A coulomb is the charge of 6.24 billion billion electrons. We don't often run into coulombs in everyday work because we don't have any coulomb meters to measure them, but the concept of charge underlies everything we do in electronics.

Alessandro Volta, in Italy, invented the electric battery in 1800 by stacking a large number of alternating copper and zinc plates separated by saline-soaked cardboard. Prior to his invention there was no such thing as an electric circuit or a continuous electric current. The importance of his invention, and of the concept of electromotive force, can hardly be overstated; yet the unit of the volt for EMF was not widely used until after an 1891 standards conference sponsored by the American Institute of Electrical Engineers.

Hans Christian Oersted (Danish) established the link between electricity and magnetism in 1820 when he noticed that a compass needle was affected by a current-carrying wire. The unit of magnetic field strength (an obscure thing) is named for him. André-Marie Ampère (French) read of Oersted's discovery; within a year, he had invented the electromagnetic coil and developed a mathematical theory quantifying how electric currents produce magnetic forces. The unit of current, which equals a flow rate of one coulomb per second, is named for Ampère.

In 1827, Georg Simon Ohm (German) developed the famous law which bears his name. Legend has it that, lacking an ammeter, he used his bodily shock sensation to judge the increasing currents due to increasing voltage: "60 cells — that tickles; 90 cells — ouch; 120 cells — yikes!" Henry Cavendish, an Englishman, had proposed the $I = E / R$ relationship years earlier in private writings which remained unknown until the late 1800s, when James Clerk Maxwell edited and published his papers. As with Leif Eriksson and Columbus, it was not the one who made the first discovery, but the one who first revealed it to the world who was honored. The unit of resistance might have been the Cavendish, but it is the Ohm.

James Watt was a Scottish engineer who improved the design of the steam engine in 1769 by using a separate condenser chamber to cool the steam back to water. Thomas Newcomen had invented a rather clumsy steam engine in 1712, and modern high-pressure steam engines were developed by Richard Trevithick around 1800, but Watt was chosen over them to have the unit of electrical power named after him. At first this may seem strange, because Watt's work was not in the electrical area. But in the metric system the unit of power — mechanical or electrical — is the watt. The equivalency in English units is 746 watts = 1 horsepower.

Unit Men, Part 2

The capacitor originated in Leyden, The Netherlands, in 1746, and was called the Leyden jar. In form it was a glass jar, partly filled with a conductive liquid, and wrapped with a metal foil on the outside. Static charges were stored in the jar, giving rise to the notion that electricity was a form of fluid. Capacitors in their modern form were developed by battery inventor Alessandro Volta in the 1820s.

Strange then, that the unit of capacitance, the farad, was named for Englishman Michael Faraday, whose work was not mainly in capacitance, but in electromagnetism and induction. Faraday discovered that a force existed on a current-carrying wire in a magnetic field — the basis of the electric motor — in 1821. In 1831 he discovered that a constant magnetic field would not induce a current in a coil, but a changing field would — the basis of the transformer.

Faraday kept detailed notebooks covering decades of meticulous experiments in electricity. He did not have the mathematical talent of other researchers, and wrote touching letters begging them to put their results in everyday language so he could incorporate their insights into his experiments.

Joseph Henry (American) had discovered the transformer principle a year earlier than Faraday, but Faraday was the first to publish, so the credit is given to him. Henry developed an electromagnet capable of lifting 750 pounds

Continued on page 61

Calendar Events

Listings are free of charge as space permits. Please send us your Calendar Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the November issue, we should receive it by August 31. Provide a clear, concise summary of the essential details about your Calendar Event.

AUG 4

LEWISTOWN, PA Juniata Valley ARC, and the Decatur Township Fire Co., will host a hamfest at the Decatur Township Fire Co. grounds on U.S. 522 North (8 miles east of Lewislown PA). The event begins at 8 a.m. Admission is a $2 donation. XYL and kids admitted free. Tailgating $5 donation. Food will be available. Talk-in on 146.91 MHz. For more info call *Richard Yingling* at *(717) 242-1882.*

AUG 5

BERRYVILLE, VA Shenandoah Valley ARC will host their hamfest at Clarke County (Ruritan) Fairgrounds in Berryville VA starting at 6 a.m. on August 5th. Take I-81 at (Winchester) Exit 315 to Rte. 7 East (9 miles), bear right onto business Rte. 7 just before the traffic light. Fairgrounds on the left; OR Intersection of Rte. 340 and Rte. 7 in Berryville, go west approx. 2 miles. Fairgrounds on the right. ARRL VE exams at 1 p.m. Ruritan barbecue chicken dinners. Talk-in on 146.82. Admission $5, tables $12–$20. Contact *Brian Mawhinney WB3FUM, 2432-69 Berryville Pike, Winchester VA; (540) 665-0761.* E-mail *[WB3FUM@arrl.net;* Web site *[http://www.Vvailey.com/svarc].*

AUGUST 11

HUNTINGTON, WV Amateur radio and computer hobbyists from all over the mid-west will be in Huntington WV on Saturday, August 11th, for a giant hamfest and computer show at the Veterans Memorial Field House, 2590 Fifth Ave., 8:30 a.m.–2 p.m. The event is being sponsored by the Tri-State ARA. Tables paid for by July 31st are $8 each; $12 at the door (if still available). Call *Ezra Taylor N8KTA, (304) 429-1667.* VE exams at the Field House; be there by 10:00 a.m. for registration. All examination elements, written and Morse Code, where applicable, will be offered for all classes of amateur radio licenses. A fee of $10 will be charged per test. Pre-registration is not necessary but applicants must present two forms of acceptable identification, Including one picture ID. Bring the original of any ham license currently held, and any Certificate of Successful Completion of Examination (CSCE) to claim credit from a previous exam. *Garry Ritchie W8OI,* leader of the TARA VE team, may be contacted at *(304) 733-1300,* for further details.

LONGVIEW, WA The Lower Columbia ARA, W7DG, will sponsor its 10th Annual Ham Radio, Computer, & Electronic Equipment Swap Meet from 9 a.m.–1 p.m. at the Cowlitz Co. Expo Center in Longview. Admission $4, tables $10, tailgate spaces $5. Commercial dealers may contact the LCARA to register for free tables, and admission. NW radio clubs can also register for a free club table; attendants pay only for admission. Food concessions, free parking, overnight RV parking on the fairgrounds for $12; electrical hookup available. Sorry, no VE exams. Vendor set up on Friday from 5–9 p.m.; Saturday from 6:30–8:45 a.m. Talk-in on 147.26(+), PL 114.8. Take exit 36 or 39 off Interstate 5 and follow the signs west for the Expo Center (or fairgrounds). Mt. St. Helens and Oregon coast nearby. For more info, write to *LCARA Swap Meet, P.O. Box 906, Longview WA 98632;* or call *Bob KB7ADO at (360) 425-6076 in the evening.* E-mail *[kb7ado@aol.com].* Link to flyer online at *[www.qsl.net/nc7p/].*

AUGUST 12

GREENTOWN, IN The 4th Annual Greentown Hamfest will be sponsored by the Kokomo and Grant County ARCs, and the ARRL, Sunday, August 12th, at the Greentown Indiana Lions Club Fairgrounds. This event will be held 8 a.m.–1 p.m. Vendors must pre-register by sending a form *[www.grantarc.com/greentown.html],* or by E-mail to *[k9nqw@skyenet.net].* Talk-in on 146.91 and 146.79. Handicapped parking available. Anyone who obtains a Tech license at the VE testing session will be admitted free. Tickets in advance are $4 each, admission at the door is $5, 12 and under admitted free. Vendor set up is Saturday, 6 p.m.–8 p.m.; Sunday 6 a.m.–8 a.m. Inside tables $8 plus ticket; tailgate set up $3 plus ticket. Contact *Greentown Hamfest, c/o. L.B. Nickerson K9NQW. 517 N. Hendricks Ave., Marion IN 46952;* tel. *(765) 668-4814;* or E-mail *[k9nqw@skyenet.net].* The Web site is *[www.grantarc.com/greentown.html].*

ST. JOSEPH, MN The 54th St. Cloud ARC Hamfest Invites all radio hams, and those interested, to the "Middle of the State Flea Market and Fun Time," 9 a.m.–2 p.m. Set up starts at 8 a.m. The event will be held at the Del-Win Ballroom on Hwy. 75 and 88th Ave., near St. Joseph MN. Talk-in on 147.015 MHz, gabbing on 146.940 MHz. VE exams at 1 p.m. For current info check the Web site at *[www.w0sv.org].*

PEOTONE, IL The Hamfesters Radio Club Hamfest, featuring amateur radio, computers, and electronics, will be held at Will County Fairgrounds in Peotone IL. Exhibits open at 8 a.m. in a fully air-conditioned building. Flea market open 6 a.m.–3 p.m. No additional charge for flea market space. Set up Saturday, August 11th, 1 p.m.–11 p.m. Advance tickets $5 w/double stub, $6 at the gate w/single stub. Children under 12 free. For advance tickets (SASE and check by July 25th), and info, contact *Robert Nelson WB9WFR, 1720 Vollmer Rd., Flossmoor IL 60422; tel. (708) 756-7984,* or E-mail *[WB9WFR@aol.com].* Talk-in on 146.52 simplex and 146.64(-107.2) STARS rptr.

SHREWSBURY, PA Blaze a hot trail to the Shrewsbury Firehouse to have fun at the Shrewsbury Ham and Computer Swap Fest. From Baltimore take Route I-83N. From York and Harrisburg take Route I-83S to Exit 1. Take Route 851 West 1/2 mile to the Shrewsbury Firehouse on the right. Talk-in on 146.700. Gates open at 07:00. Gate fee is $5 for everyone over 12 (tailgating not included). Outside tailgate spaces are $3 per space. Inside tables are $10 each. There will be a mid-morning Fun Auction. Equipment, parts, etc., will be accepted as donations to the Swap Fest sponsors, or will be auctioned for a 10% fee. Items not donated must be clearly marked with a name or call sign for record keeping. This Fest will provide a place for you to swap, trade, or sell your excess or unwanted equipment. Hopefully you will also find something you have been looking for. Hot and cold food services will be available on the grounds. VE exams will be held Saturday, August 11th at the Shrewsbury Borough building. Registration 9:30 a.m.; testing 10 a.m. Contact *Carol Kirschman (717) 235-0273;* or E-mail *[carol@nfdc.net].* For more swap fest info, please contact *John Salony (717) 741-1780;* Table sales, *Bill Kirby W3PNQ@yahoo.com]; Cecil Mundorff* by fax, *(717) 927-9282,* or phone *(717) 927-6662.* The Web site is at *[www.carli-online.com/hamfest].* This event is sponsored by the Southern PA Group; Hilltop Transmitting Assn.; and York White Rose Amateur Radio Clubs.

AUG 18

OAKLAND, NJ The Ramapo Mountain ARC will hold its 25th Annual Ham Radio and Computer Flea Market on Saturday, August 18th, at the American Legion Hall, 65 Oak St., Oakland NJ 07436. Vendors admitted at 6 a.m., buyers 8 a.m.–noon. The kitchen opens at 7 a.m. Donations $4 (XYL and harmonics free). Inside tables $10. Tailgating $8. Talk-in on 147.49/146.49 and 146.52 simplex. For info please contact *Steve Oliphant N2KBD, 10 Glen Rd., Ringwood NJ 07456-2331*; tel. *(973) 962-4584*, fax *(973) 962-6210*. Club E-mail *[rmarc@qsl.net]*, Club Web site *[www.qsl.net/rmarc]*.

AUG 18–19

HUNTSVILLE, AL The Huntsville Hamfest and Alabama ARRL Section Convention will be held Saturday and Sunday, August 18th and 19th, at the Von Braun Center, 700 Monroe St., Huntsville AL. Admission is $6, under 12 free. Doors open both days at 9 a.m. VE exams will be held both days at 10 a.m. Forums include ARRL, MARS, Skywarn, QRP and *more*. Convenient parking. Giant dealer/manufacturer show, huge flea market, E-Z drive-in vendor unloading, DX banquet and more. Friday and Saturday night hospitality rooms at the Huntsville Hilton. Talk-in on 146.94(-), call K4BFT. For special hamfest rates at the Huntsville Hilton, call *(256) 533-1400*. Other contacts: Dealer show, (256) 536-3904; flea market (256) 883-2760; Forums *(256) 539-8950*; DX banquet *(256) 721-5996*. For general info call *(256) 880-8004*. Visit the Web site at *[www.hamfest.org]*.

AUG 19

LAFAYETTE, IN The Tippecanoe ARA will host their 31st Hamfest on Sunday August 19th, from 8 a.m.–2 p.m. at the Tippecanoe County Fairgrounds, 1401 Teal Rd. (SR 25). Admission is $4, children under 12 admitted free. Parking is free and there is no additional charge for vendors inside or outside. Talk-in on 147.135(+) and 443.775(+), use 88.5 Hz PL tone for both. VE exams will be conducted at noon at the Lafayette Red Cross Office. For more info check the Web site at *[www.w9reg.org]*, or contact *David Dull WB9BRX* by E-mail, *[dave@dullville.com]*, or tel. *(765) 743-8305*.

AUG 25

LAPORTE IN The LaPorte ARC will host the LPARC Summer Hamfest, Saturday, August 25th, at LaPorte County Fairgrounds, State Road 2 west of LaPorte, 7 a.m.–1 p.m. Admission $5, tables $10, outdoor tailgating $2. Talk-in on 146.52 and 146.61(-) PL 131.8. For more info contact *Neil Straub WZ9N, P.O. Box 30, LaPorte IN 46352; tel. (219) 324-7525*. E-mail *[nstraub@niia.net]*. The Club Web site is at *[www.geocities.com/K9JSI]*.

AUG 25, 26

ALBUQUERQUE, NM The New Mexico Hamvention, Inc., will sponsor the Duke City Hamfest, August 25th and 26th, at the Rio Rancho National Guard Armory, 4001 Northwest Loop. Take 1-25 to Bernalillo, west on US 550 (NM-44), approximately 8 miles to the Armory (watch for signs). Doors open Saturday at 8 a.m–5 p.m., Sunday 8 a.m.–1 p.m. Flea market, tailgates $5, VE exams, forums. Free admission. Talk-in on 145.33(-) and 444.00(+) (100 Hz). RV parking, no hookups. Tables $12 without power, $17 with power or along the walls. Contact *Marcus Lieberman KM5EH, 2300 Hurley Dr. NW, Albuquerque NM 87120*; tel. *(505) 836-1724*, fax *(505) 352-6154*. E-mail *[km5eh@arrl.net]*, or check the Web site at *[www.qsl.net/dchf]*.

SEP 7, 8

MENA, AR The Queen Wilhelmina Hamfest Association will present their 32nd annual Mena Hamfest on September 7th and 8th at the Queen Wilhelmina State Park near Mena AR. The location is 13 miles west of downtown Mena, on Hwy. 88. Talk-in is on 146.79, 100 Hz tone. For flea market spaces, contact *Charlotte Lee KC5DOR* at *[clee48@ipa.net]*, or *415 Crosstrails Rd., De Queen AR 71832*. The Grand Prize will be a DX70.

SEP 8

BARTONSVILLE, PA The Eastern Pennsylvania ARA and The Pocono ARK will co-sponsor the Pocono Area Hamfest and Electronics Exposition, Saturday, September 8th, at the Monroe County Vo-Tech in Bartonsville. This event will feature new and

previously owned equipment, electronics parts, radios, computers, and more. Admission $5, children and spouses free. Gates open at 8 a.m. for the general public. Vendors: $15 inside space 12 ft. x 6 ft. each; $5 outside space 10 ft. x 20 ft. each. Vendor gates open at 6 a.m., with set up *before* 6 a.m. Set up time must be pre-arranged. Talk-in on 147.045(+) PL 131.8, 146.865(-) PL 100, or 146.535 simplex. VE exams will be available. For further details contact *Bill Connelly W3MJ* at *(570) 424-2174;* or *Jerry Truax* N3SEI at *(570) 620-9080.* The theme of this event is "Public Service & Fun for the Whole Family." Various area public service agencies, the National Weather Service, Search and Rescue, Fire Dept., etc., will be on hand, as well as many vendors and exhibitors.

SEP 9

BALLSTON SPA, NY The Saratoga County R.A.C.E.S. Assn. Inc. will hold its 16th Annual Hamfest on Saturday, September 9th, at the Saratoga County Fairgrounds in Ballston Spa. This will be held rain or shine, all under cover. Gates open at 7 a.m., with the hamfest running until 3 p.m. Admission is $5, including 1 tailgate spot and free parking. There will be door prizes, a fox hunt, VE exams, and plenty of food. Talk-in on 146.40/147.00 and 147.84/.24. Reserved tables $5 each, first come, first served. Reservations and pre-pay welcome and encouraged. Early set up for all vendors. For further info and/or reservations, contact *Darlene Lake N2XQG, 314 Louden Rd., Box #84, Saratoga Springs NY 12866;* tel. *(518) 587-2385,* E-mail *[lake@capital.net].*

BETHPAGE, NY The LIMARC Fall 2001 Electronics Hamfair and Flea Market will be held Sunday, September 9th, at Briarcliffe College, 1055 Stewart Ave., Bethpage NY. Gates open at 7 a.m. for vendors, and at 8:30 a.m. for buyers. Outdoor tailgating only, rain or shine. Each space is $15 and includes admission for one person. Additional workers will be $6 each. No advanced registration needed. General admission is $6, children 12 and under accompanied by a paying parent, as well as non-ham sweethearts, are free. For more info visit the LIMARC Web site at *[http://www.limarc.org],* or call the 24-hour hotline at *(516) 520-9311.* Talk-in is on the 146.850 rptr., PL 136.5. E-mail *[hamfest@limarc.org].*

SOUTH DARTMOUTH, MA The Southeastern Massachusetts ARA, Inc., will hold its annual flea market on the club's grounds at 54 Donald St., South Dartmouth MA. The event will run from 9 a.m.–1 p.m. Talk-in on 147.00/.60. Admission $2, spouse and children free. Food, door prizes, walk-in VE exams (10 a.m.), and more. Free space for vendors! For further info contact *Tim Smith N1TI* at *(508) 758-3680;* or by E-mail at *[rt_smith@yahoo.com].*

SEP 14, 15, 16

PEORIA, IL The Peoria Area ARC will host the Peoria Superfest 2001 Amateur Radio, Computer and Electronics Show at Exposition Gardens, Peoria IL. The flea market will be held 3 p.m. until dark on Friday, September 14th. Live music will be presented Saturday night in the South Garden Pavilion. VE exams will take place Sunday, 10 a.m.–1 p.m. Gates open 3 p.m. Friday, 6 a.m. Saturday and Sunday. Commercial buildings will be open Saturday, 8 a.m.–4:30 p.m., and Sunday, 8 a.m.–3 p.m. Advance tickets are $5 with two stubs; $7 at the gate with one stub. All tickets good for the weekend. Outdoor flea market space can be reserved in advance for $5, plus $5 for each admission ticket. Space and admission tickets are good for the entire weekend. Set up for the outdoor flea market will be Friday at 10 a.m.; 6 a.m. Saturday and Sunday. Set up for indoor commercial vendors will be Friday, 2 p.m.-9 p.m.; Saturday, 6:30 a.m.; Sunday, 7:30 a.m. Talk-in on 147.075(+). Visit the Web site for the latest Superfest info *[www.w9uvi.org].* E-mail for tickets and space reservations to *[w9uvi@arrl.net].* The postal mail address is *Peoria Superfest, P.O. Box 3508, Peoria IL 61612-3508.*

SEP 22

NEW PORT RICHEY, FL The Suncoast ARC will hold the 11th Pasco County Hamfest 9 a.m.–3 p.m. on September 22nd, at the New Port Richey Rec. Center, 6630 Van Buren Rd., New Port Richey FL. Admission $5, XYLs and under 12 free. Tables $15 each, electric $5. Tailgate spaces $3 each. You must have admission to enter tailgate or exhibit hall. This event will be held inside with air conditioning. For more info, contact *Owen Godwin KI4CT, (813) 909-1336;* E-mail *[KI4CT@ARRL.NET].* Talk-in on 145.35 rptr.

SPECIAL EVENTS, ETC.

AUG 18–20

42nd ANNUAL NEW JERSEY QSO PARTY The Englewood ARA, Inc. invites all amateurs the world over to take part in their 42nd Annual New Jersey QSO Party. Rules: (1) The time of the contest is 2000 UTC Saturday, August 18th–0700 UTC Sunday, August 19th, and 1300 UTC Sunday, August 19th–0200 UTC Monday, August 20th. (2) Phone and CW are considered the same contest. A station may be contacted once on each band — phone and CW are considered separate bands. CW contacts may not be made in phone band segments. New Jersey stations may work other New Jersey stations. (3) General call is "CQ New Jersey" or "CQ NJ." New Jersey stations are requested to identify themselves by signing "De NJ" on CW and "New Jersey calling" on phone. Suggested frequencies are 1810, 3535, 3950, 7035, 7235, 14035, 14285, 21100, 21355, 28100, 28400, 50-50.5, and 144-146. Suggest phone activity on the even hours; 15/10 meters on the odd hours [1500–2100 UTC]; 160 meters at 0500 UTC. (4) Exchange consists of QSO number and QTH (state/province or country). New Jersey stations will send county for their QTH. (5) Scoring: Out-of-state stations multiply number of complete contacts with New Jersey stations times 3 points per QSO times the number of New Jersey counties worked (maximum of 21). New Jersey stations multiply number of complete contacts times 3 points per QSO times the multiplier. The multiplier is the sum of the number of states (other than NJ), Canadian provinces, and NJ counties worked. Maximum is 49 + 13 + 21 = 83. (6) Certificates will be awarded to the first place station in each New Jersey county, state, province, and country. In addition, a second place certificate will be awarded when four or more logs are received. A total of two plaques have been donated by the ARRL Section Managers for NNJ and SNJ to the highest scouring single operator station residing in each of their sections. (7) Logs must show the UTC date and time, QSO exchange, band, and emission, and be received no later than September 15th, 2001. The first contact for each claimed multiplier must be indicated and numbered, and a check list of contacts and multipliers should be included. Multi-operator stations should be noted and calls of participating operators listed. Logs and comments should be sent to *Englewood Amateur Radio Assn., Inc., P.O. Box 528, Englewood NJ 07631-0528 USA.* A #10 size SASE should be included for results. (8) Stations planning active participation in New Jersey are requested to advise EARA by August 1st of your intentions so that plans can be made for full coverage from all counties. Portable and mobile operation is encouraged.

Mobile, Portable and Emergency Operation

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"Proudly Serving Those Who Serve"

When we talk about the importance of portable, mobile, and emergency communications we usually think about amateur radio's role. There are other communication services as well that are key players in these areas, however, some of which are closely associated with amateur radio. One of these is the Military Affiliate Radio Service or MARS. There is one MARS service associated with the Army and Air Force and another supporting the Navy and Marine Corps. As a member of the Navy-Marine Corps MARS program, (whose motto is our title this month) I'll focus on that, although most of the concepts are similar for Army-Air Force MARS.

There is a long tradition of association between amateur radio and the U.S. Navy that dates back to the earliest days of wireless communications. This cooperation helped the Navy to attract many amateur radio operators as service members during both world wars. Today Navy MARS provides the Department of the Navy and the Department of Defense with a source of emergency communications on a local, national, and international basis as an adjunct to normal naval communications. Day-to-day MARS operations are performed to train operators in the skills they might need to fill this role in an emergency or other contingency.

The most important role for the MARS operator is to provide communications in the unexpected situation. Just like in any other emergency service, we don't know what the next emergency will be so we have to prepare for a wide range of possible events. It could be a weather emergency or other disaster similar to what we prepare for as amateurs involved in the Amateur Radio Emergency Service (ARES) or the Radio Amateur Civil Emergency Service (RACES). On the other hand, with MARS the event could be unique to the needs of the military.

Even in this day of global communication by satellite and a cellular phone in every pocket or purse, MARS fills a very real need. When the military provided logistics and supply support for Operation Deepfreeze in Antarctica, telephone communications were augmented by Navy MARS. Telephone coverage was limited, so MARS provided phone patches so that personnel on "the ice" could call home. During Operation Desert Storm in the Arabian Gulf, banks of telephone booths were set up for the use of the troops. The lines to use these phones were monumental, and once again MARS was there to help out the troops. If you've ever been deployed to some far-off land, you'll understand how important this is to the average GI, and today's young men and women are used to being in frequent communication with friends and family.

How does an amateur become a member of MARS and what are the qualifications? If you have a Technician-class license or higher, you meet the first requirement. You must be a U.S. citizen or be a legal permanent resident seventeen years of age or older. You must have a station that can operate on a minimum of two MARS frequencies within the 2–30 MHz range that are used in your area. You must complete a correspondence course and you must be willing to operate for a minimum of 18 hours each quarter. That's all there is to it!

What are the benefits? First, you have access to frequencies that are specifically authorized for MARS use. These frequencies are assigned to different areas at specified times and can only be used as part of a network. Most modern transceivers can be readily modified to operate on these frequencies and MARS members have access to information on these modifications. From time to time, equipment may be made available to MARS operators that the government no longer needs for other purposes. During emergency situations, the MARS frequencies are legally more protected than amateur frequencies. This means that sensitive information can be transmitted without it being repeated on the local news. Members of the Navy Reserve can receive credit for their participation. Finally, it's yet another fun aspect to the amateur radio hobby!

If you enjoy (or are just curious) about traffic handling, this is a natural extension. Military communications procedures are carefully defined, particularly given the types of messages upon which the military depends. While MARS operators are not involved in tactical situations, the precision required does make for a more regimented approach even for more mundane traffic. Net control is more active than in many amateur nets, with a structure that permits prioritization of traffic and its efficient handling.

In the Navy MARS system, it is possible to move up to higher status in the organization in a manner similar to ranks for radio operators in the Navy. This provides a level of recognition for achieving higher levels of capability. There are also a number of important jobs that must be performed within each MARS region. There are individuals assigned specific areas of responsibilities as directors and coordinators. Some assignments are by geography while others are by area of responsibility, such as emergency communications or training.

Curious? A good starting point is one of the Web pages that are operated by MARS. For the Navy-Marine Corps, check out [http://navymars.org]. For the Army-Air Force, use [http://www.asc.army.mil/mars/]. There is a lot of good general information

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Amateur Radio Via Satellites

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Modes Explained

What's the difference between a typical Mode "B" satellite station and one that's ready to go for Mode "US" on AMSAT-OSCAR-40? The answer is simple and easy; an inexpensive surplus downconverter, a cheap dish, and some 75-ohm TV coax cable.

Mode "B" is defined as a satellite transponder using 70 cm as the uplink band and two meters for the downlink. The "B" comes from the first hamsat to incorporate multiple transponders, AMSAT-OSCAR-7. AO-7 was launched in 1974 and had different modes that were commanded from the ground. They were labeled according to digital circuit states A, B, C, and D. Mode "A" was the two-meter up and 10 meter down transponder. Mode "B" was the 70 cm up and two meter down transponder in the high-power (10 Watt) configuration. Mode "C" was the low-power (2.5 watt) version of Mode "B". Finally, Mode "D" was control for the 70-cm telemetry transmitter. It could be set to either on or off while the satellite was in Mode "D".

Over the last quarter century, we have retained the mode labels that began with AO-7, but have recognized that the system is antiquated and not logical. AO-40 is the first satellite to use labels that make a bit more sense. Mode "B", for instance, is now called Mode "UV", where the "U" stands for UHF (70 cm) and "V" is for VHF (two meters). The ground station transmit band is first with the receive band noted second.

During World War II, letter labels were applied to the microwave bands associated with RADAR systems developed by the Allies. The letters were used in an attempt at secrecy. We still use these labels, and others that were attached to various frequency ranges after the war. On AO-40, "US" means UHF up and SHF (13 cm) down. Another common mode is "LS" for 23 cm up and 13 cm down.

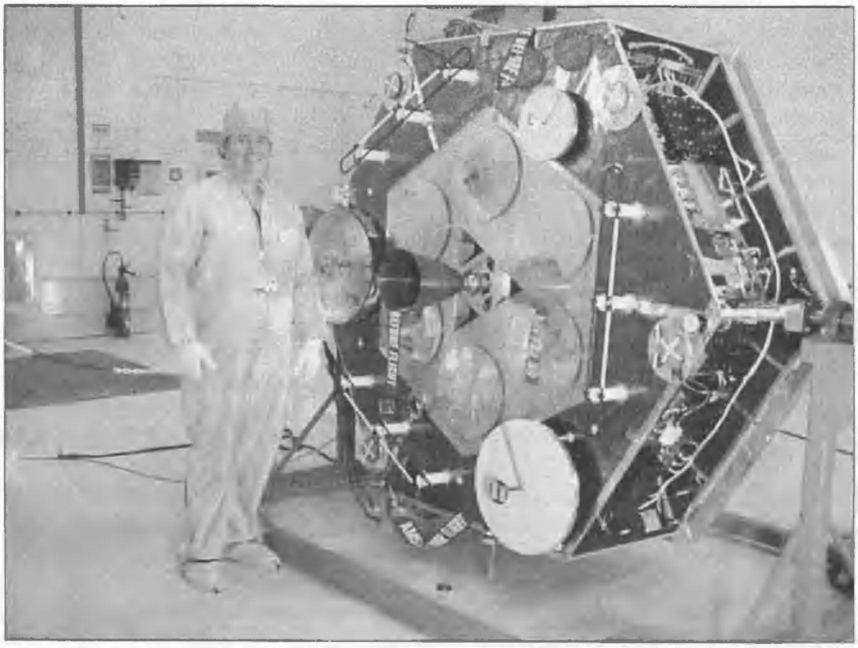

Photo A. Peter DB2OS and AO-40 a few days before launch from Kourou. Most of the antennas are on the same side of the satellite as the main motor. (AMSAT-DL photo)

The great day

On May 5th, Stacey Mills W4SM activated "US" and "LS" operation on AO-40 at 0800 UTC. This was not a closed test operation. This was the first day of open communications operation for anyone who had the interest and gear to make some contacts. There are two Mode "S" systems on AO-40. The one that was activated (S2) can run 50 watts to a helix located on the motor side of the satellite. There is an additional higher-gain dish antenna on the other S1 system, but it was not used due to its narrower beam pattern since the satellite was not oriented for optimum gain at the center of the viewable earth. It was however, good enough for many stations to make contacts, mostly using simple receive systems.

Although a few hams had expensive antennas and downconverters ready for the first day of operation, the majority were using modified MDS (Multipoint Distribution Service TV) converters and "BBQ-grill" dishes to receive the signals around the S2 telemetry beacon on 2401.350 MHz. Any installation that can receive the S-band signal from UoSAT-OSCAR-11 on 2401.5 MHz can be used for successful AO-40 operation. The March, 2001, "Hamsats" column discusses various cheap downconverters, while the May, 2001, column shows pictures and provides details and some alternatives.

Most downconverters are powered through the 75-ohm TV coaxial cable that brings the lower-frequency, 2-meter signals back to the shack. Mode "S" converters are typically mounted at the antenna, since losses in almost any cable are prohibitive at these frequencies. The DC power is easily

sent through the cable using chokes to block RF and pass DC, and capacitors to block DC and pass RF. Most converters are powered on all the time. This keeps the internal oscillator somewhat stable, and heat from the internal voltage regulators keeps condensation from collecting inside the unit. If you are using a 2-meter transceiver for AO-40 reception, be sure that it cannot transmit while the down converter is connected. It's very easy to burn out a converter with only a few watts on 2 meters.

Getting on the air

The time to get your system ready for 2400 MHz reception is now. Check out the previous "Hamsats" columns noted above and the October 2000 Special Satellite Issue of *73*. Any system that has enough power on 70 cm to work the now-antique AMSAT-OSCAR-10 (about 50 watts to a yagi) will have plenty for AO-40. If you transmit too much power, don't be surprised if you hear from LEILA (LEIstungs Limit Anzeige), the "Power Limit Indicator." Any uplink signals that exceed recommended levels are first warned by a beeping sound through the downlink. If the problem persists, LEILA notches out the signal so that it cannot desense the satellite's receiver.

For those who can generate about 100 watts ERP (Effective Radiated Power) on the 23 cm uplink, Mode "LS" is a fun alternative to Mode "US." Mode "LS" is usually activated simultaneously to Mode "US." An Icom 1271A with 10 watts on 1.2 GHz through some very low-loss cable, to a 45-element, linearly polarized loop yagi, will be quite enough to do the job.

AO-40 is not always aimed directly at the earth. To know when the satellite is best for you, the orientation of the spacecraft can be input as data in some of the better tracking programs. The numbers to use are called ALON and ALAT. When these two numbers are both zero, the main motor and the Mode "U", "L", and "S" antennas are aimed at the center of the earth when at apogee, or the high point of the orbit. Unlike some previous satellites, the main motor is on the same side of the satellite as most of the antennas. Best signals will always be found when the satellite's antennas are aimed your way. InstantTrack from AMSAT [http://www.amsat.org] generates an off-pointing angle value when given accurate ALON and ALAT data. The higher the off-pointing, the poorer the signals, both up and down.

What's next?

In the days and weeks since that first day of open operation on AO-40, ground controllers have run tests on other receivers and transmitters. The digital communications system, RUDAK, is working well. When loaded with appropriate software, the satellite can be used for many types of digital operations without impact on the analog voice and CW activity. The first tests on the 10 GHz transmitters were not successful. Commands were sent to the satellite to activate both the solid-state unit and the TWT (traveling wave tube). There were no indications that anything had happened. There was no apparent RF output and no temperature changes inside the transmitters. Early tests on the 24 GHz transmitter were inconclusive. Although nothing was heard from the satellite during the first test, the satellite was not well aimed for the ground stations trying to receive the signals on 24048.150 MHz. More tests will be done later.

In late May and early June the satellite was reoriented to fire the ammonia arc-jet motor. While the main motor is out of commission due to the problems encountered in December, 2000, ground controllers in Germany are attempting to raise the perigee, or low point of the orbit. Without firing the arc, the energy available from the smaller motor is minimal, but should be enough to have some effect. It is hoped that the perigee can be raised a few hundred kilometers.

To stay tuned into the current status of AO-40, check out the AMSAT Web site noted above. If you are not currently subscribed to the various AMSAT remailers, and can stand a few hundred E-mails per week, consider subscribing to "amsat-bb" for current discussions and "ans" for official AMSAT news. Subscription instructions are available on the Web site. Another very useful source of updates is the German AMSAT-DL site [http://www.amsat-dl.org]. 73

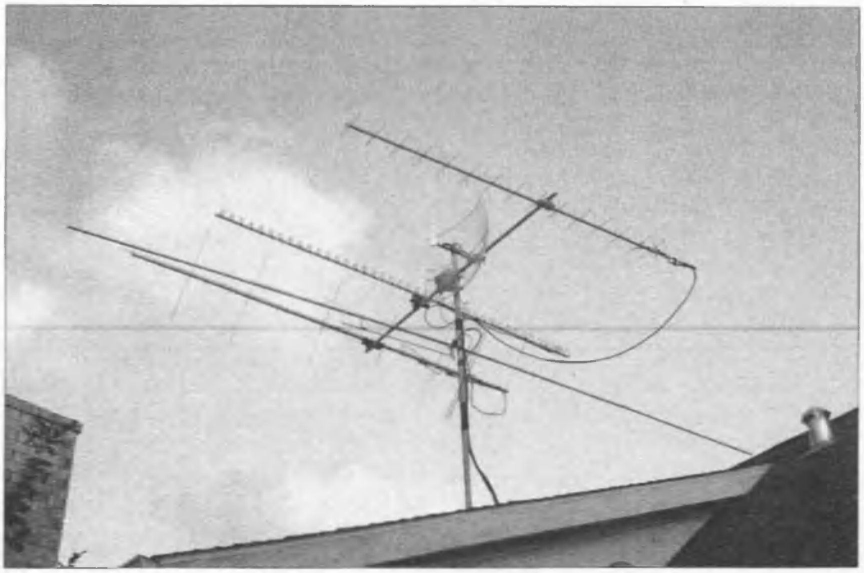

Photo B. The 13-cm receive system, complete with Drake 2880 downconverter and "BBQ-grill" reflector, fits easily in this ground-station array which includes antennas for two meters, 70 cm, 23 cm, and even a dipole for 15 meters.

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Neat Stuff Wish List

It's hard to believe, but summer is just about gone. It's time for campouts, picnics, and QRP! Today, you can carry equipment in your backpack that just a few years ago was someone's imagination. What a great time to be a ham radio operator!

If you're into camping and backpacking and like to bring along your QRP radio, here's a wish list of really neat stuff to have. These are just my opinions, and like they say, opinions are like armpits. Everyone has two and they usually stink. So, here's my pick. The first choices are the multiband radios. Then the monoband radios.

My top pick for portable QRP: The Yaesu FT-817

With the introduction of the Yaesu FT-817 this year, this is one radio that will soon find its place in a lot of campsites. This would be my choice today. It does just about everything you can imagine a radio should do. If you don't want to work the world, then how about sitting back on a log while listening to the BBC?!

And there's more! Besides CW, the FT-817 does a nice job on SSB. And you never know when you might need the FM capabilities of the radio. You can scan the public service bands, too. The Yaesu FT-814 is a QRP field operator's dream machine.

The K1 by Elecraft

If you don't happen to have $800 for the FT-817 sitting around, or if you are backpacking and need things lightweight, then consider the K1 from Elecraft. The base price for the K1, including your choice of two bands, is $269. The K1 is a dual-band; any two of the ham bands are included in the base kit. You can purchase extra band modules to cover another two bands. The K1 is a very lightweight CW-only transceiver. If you need to conserve weight, then the K1 is the backpacker's dream transceiver.

It's microprocessor-controlled, and uses a very slick digital display to show you what's going on at any given time. You can also add the internal antenna tuner to the K1.

What's nice about the K1, and the FT-817, too, is that they both will produce up to five watts of OUTPUT. It's one thing to run one watt from home. There you have all kinds of wire, aluminum, and towers to squirt your one watt into. Setting up camp by a river may make for a spectacular view, but may not be the best place to string an antenna. When taking QRP into the field, go with at least a chance to be heard, even if it requires you to run a whopping five watts.

The HW-8 comes in third place

If you only want to play radio while the burgers cook on the grill, then the Heathkit HW-8 would be my third choice. It's small and lightweight and easy on the batteries. Although CW-only, it does cover four bands. There's bound to be some activity on one of the four bands at any time day or night.

The HW-8 does have a downside. It will only produce about three watts on 80 meters and about half that on 15 meters. It's not a robust performer when compared to the five watts from the first two transceivers.

It does have a dietlike demand for current from the battery. Standby current is only 100 mA or so. A 7.5 amp-hour battery will last more than a weekend of QSOs.

The monobanders

If I had to pick one band for making QSOs, it would be 40 meters. And my radio of choice for working 40-meter CW at the campsite would be the ARK-40 from S&S Engineering. This rig is built like a tank! It's no lightweight, and I sure would not want to backpack it up the trail. But for use at the campsite, there's nothing better. What I like about the ARK-40 is the ability to dial up a frequency and know that what you see is where you're at. Yes, the goofy push-button frequency selection does take some getting used to, but once you have it mastered, it's not too bad after all!

Right offhand, I don't know if S&S Engineering is still in the QRP kit business or not. I have not heard from them in a while and have not seen any of their ads in any of the magazines for some time.

So, if you can't get one of the ARK-40 rigs, the next choice would be one of the monobanders from MFJ. Available on most of the popular QRP bands, they are assembled, tuned, and tested. They also produce up to five watts of RF into the antenna. Contact your local MFJ dealer for the best price on one of these radios.

If you're into building a kit and want a monobander, then try out one of the kits from Ten-Tec. They are economically priced, coming in at about $100 a pop. They're easy to assemble; even a beginner can do it. These radios produce up to four watts of RF. They all have the famous Ten-Tec QSK break-in keying. The only thing I really don't care for in the Ten-Tec QRP radios is the pot they use as the main tuning control.

The Micro M

Back in 1996, *QST* published my Micro M article. There are hundreds of these things keeping batteries fully charged via a solar panel. At the time the Micro M was designed, I figured most people would use at least a seven amp-hour battery. But, due to the small size of the controller, a lot of guys ended up using very small amp-hour-capacity batteries.

Because the Micro M has a rather hefty

standby current of about 25 mA, it was possible to discharge a 2.2 amp-hour battery from the standby current drain of the Micro M. In effect, you used your solar panel to charge up the battery during the day, and the next morning the battery was dead. During the night the Micro M's standby current drained the battery. With a battery with a higher amp-hour rating, the effect was not as severe. Now, having said all of that, here's a modification you can do to your Micro M charge controller that will reduce the standby current to almost zero!

Micro M standby current modification

"From the factory" the Micro M standby current ranged from 12 to 35 mA. The variance is caused by different production runs of the LM358 dual comparator.

In the past, the best fix was to remove the LM358 and replace it with a micropower version of the chip. They're not cheap and not easy to come by.

But, here is a fix for the Micro M that is simple and easy to do. The results are dramatic! With an unmodified Micro M controller, the standby current went from 33 mA to .118 mA! Here's how to do the modification.

You'll need a 1N4002 diode and 2.2k resistor, and a really hot soldering iron and some desoldering wick.

1. First, position the Micro M PC board so the wire connections are facing you.
2. Locate diode D5 (as marked on the PC board). This diode is located right next to U2.
3. Clip the unbanded lead of the diode from the PC board.
4. Using a hot iron, heat the remaining lead and pull the diode out of the PC board.
5. Using the solder wick, clean out the hole (banded end) near U2. There is no need to remove the other lead left in the PC board. Just be sure you trim it off flush with the board.
6. Install a new 1N4002 diode standing up, with the banded end toward the PC board.
7. Solder the diode's lead in the PC board.
8. Bend the diode's loose end by capacitor C3 and solder it to the unbanded end of the large diode, D4. Be sure you do not allow the lead from the 1N4002 to touch any of the board's traces.
9. Flip the board over and install the 2.2k resistor across the PV- and BATT- traces. Trim the leads to prevent shorting out the board.
10. Check over your work and test the Micro M for proper operation.

OK, here's what we did

We moved diode D5 so it is now receiving power from the solar panel. At night, the entire circuit shuts down. However, since the controller switches the negative side of the solar panel, we need to supply a ground for U2, the regulator.

That's what the 2.2k resistor does. Yes, by connecting the solar panel negative and the battery negative via the 2.2k resistor, some current will flow when the controller turns off the FET. But I measured this at less than 1 mA. So, there's no need to worry about overcharging the battery through a 2.2k resistor!

Check standby current if you like. Place your VOM (set to read current) in series with your battery. You should see about 0.18 mA instead of 33 mA!

Micro M leftovers

Before heading down to the Dayton Hamvention this year, I went through the

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MixW2

Now, finally, you can download and use the MixW version 2. Large numbers of happy hams are already there. At the time of this writing, it has only been available for a couple of weeks, and it seems as though every other contact, at least, is using the new software.

I have been describing it as having a whole laundry list of modes. By a count, the mode pull-down menu lists 14 digital modes plus SSB, AM, and FM. That certainly fits the description of a laundry list in these parts.

It is hard to know where to start telling the story, with so much available, because it doesn't stop at modes. There is an excellent log system, automated database search (QRZ, RAC, and HAMCALL), plus rig control and antenna rotator control. And, just as a little extra, DXCluster from your local packet cluster or the Internet, your choice.

I had been watching the development of this software from the sidelines and knew it had gone through well over 30 beta versions. Then came the official "pre-release" when the MixW enthusiasts swooped in and found the numerous incompatibilities that crop up with such an undertaking.

That was where I started. The download produced a very compact piece of workmanship at just about an exact megabyte, zipped. Installation went off like clockwork. The author promised that registered owners of previous 1.xx versions could use their registration key on the version 2 and that worked.

Configure wasn't too difficult. The first several releases seemed to give a little resistance to operating the PTT and the rig control. By about the fourth release, life was working smoothly. Suddenly, when I got the last parameter chosen correctly, the software "knew" exactly what frequency I was operating on and turning the tuning knob caused all those numbers to parade, in-step, wherever they were displayed on the monitor.

That is, wherever the cursor was pointed and clicked, the displayed frequency was calculated and displayed in its own little box as well as in the log awaiting the next contact to be logged — along with the mode identifier also in the log and, of course, the date and time.

Then, after seeing all this, I had to try changing frequency and bands and modes and, sure enough, the rig responded to every whim of the software. Just amazing!

So, you may be asking, does all this run on that wimpy computer Jack is so attached to? The CPU in this old shack computer runs 120 MHz and it has 32 Mb RAM. That is a little short of what is recommended by the author, Nick UT2UZ, who claims to have run it on an even slower computer but adds: "Don't try this at home." However, there are published methods to conserve the resources for the computer-challenged ham — and they work.

As a matter of fact, the only thing that doesn't work when using this slightly anemic system is the DX Webcluster. When the modem cranks up, the communications slow to a crawl. I can detect that the connection is in the process but it just doesn't quite materialize. Shut down the modem connection and all is back to normal.

What is so good?

Where the value lies for you all depends on how you look at things. My feeling is that there are two great things this software does for us. The first is that it provides a platform for just about every digital mode any of us has an interest in. In so doing, the activity of at last two modes has risen instantly by some percentage points.

Until MixW2 arrived, I had heard about five Throb signals and worked three of them over a period of maybe six months. Within one week after installing the new software, I had three more contacts and many more "sightings." No one had ever ventured onto 20 meters in that mode that I had detected previously.

A similar percentage applies also to Hellschreiber. Suddenly we are hearing both Throb and Hellschreiber in the general area of 14.078–14.083. This activity is obviously due to the sudden proliferation of easy-to-change-modes-and-use software.

And therein lies a secret of encouraging activity. If you want people to play with new, semipopular modes, put the tools (toys) at their fingertips. Maybe a slightly new coinage of an old phrase would be, "Build it and they will go." That is what Nick did. He performed a labor of love that is sparking interest in modes that were losing ground to the more popular ones.

I heard at least one ham comment that he felt the specialized, single mode software packages offered more in their respective areas. I won't argue with that. One area this may be true in is Hellschreiber. I have worked several stations in this mode and the software works well. There are options missing, however, that help under poor conditions. These are not addressed in MixW2. But it is still getting more users ... just because it is there and it is easy.

There are other examples, I am sure, but this is not a forum to say what is best. That can sometimes be very distracting when we are talking about having maximum fun. I haven't seen or heard a comment from a MixW2 user that didn't include the phrase, "been having a ball." That tells a big story right there.

The other really good thing about the new software is that you can instantly switch modes. I was hesitant in the past to change from one program to another because I heard a mode I wanted to work and couldn't make the change without loading a different program and making some minor adjustments. Sometimes, the only adjustment was to my mental area, as the different packages did not function the same and I would hit the wrong keys.

Now, once the program is installed and the audio drivers are correct for one mode they will also function correctly for the other modes. And, you have more choices, but if you wish, you can use the same macros for all the modes. That really saves mixups for me. I am one big creature of habit. I don't know how many times I have rewritten macros in a program so that they would be the same combination as I had placed in other programs.

Does it work?

Yup, this program does everything it is quietly advertised to do. The PSK mode is usually the first one we look at, and it is as flawless as conditions will allow. It has a very responsive "cure" for those strange RST reports we like to send. I don't use this all the time — because it is one of the resource hogs and is recommended to be left out of the display for the slower machines — but you will see it up and working in **Fig. 1.**

It is intuitive, and the numbers are explained on the screen display so that you know why you are sending those numbers off to the other ham. Along with that is a very well done IMD reading that seems to do the job as well as possible.

MFSK is another mode that seems to be gaining a resurgence of signals with this software. This mode is one of the others the "purists" could possibly argue is better done in the devoted *Stream* software. However, once again, at least half the signals are coming from MixW2 users these past few weeks.

I just happened to think, I worked a station during the testing process in the MFSK mode, for which this mode lends itself very well. There was a station just about directly over the North Pole one evening and there was not a sign of disturbance from "pole flutter." The copy was excellent. I have tried in former times to work stations over the pole in PSK31, and sometimes it is about impossible even with strong signals. (Yes, I worked him.)

And you had better believe that RTTY works. One evening, I heard a very unfamiliar call signing from the island of Nevis, the first I recall ever hearing. I didn't jump in quite as quickly as I should have and suddenly there was a genuine pile-up. So I simply cooled my heels until the big-guns had run their course and this little peanut whistle could be heard. Got right through, and was so proud of the timing and the macros. Like clockwork.

Two new modes have worked their way in during these first releases. One of the surprises was SSTV. At this time it is pretty bare-bones, but I found a few stations transmitting images and they printed perfectly on my monitor. I have not taken time to check out file handling, but it looks as though importing an existing image would be no problem and saving couldn't be very difficult. The secrets lie in editing and slant control. Slant control is provided and image-handling hams can always find a way to fix their pics.

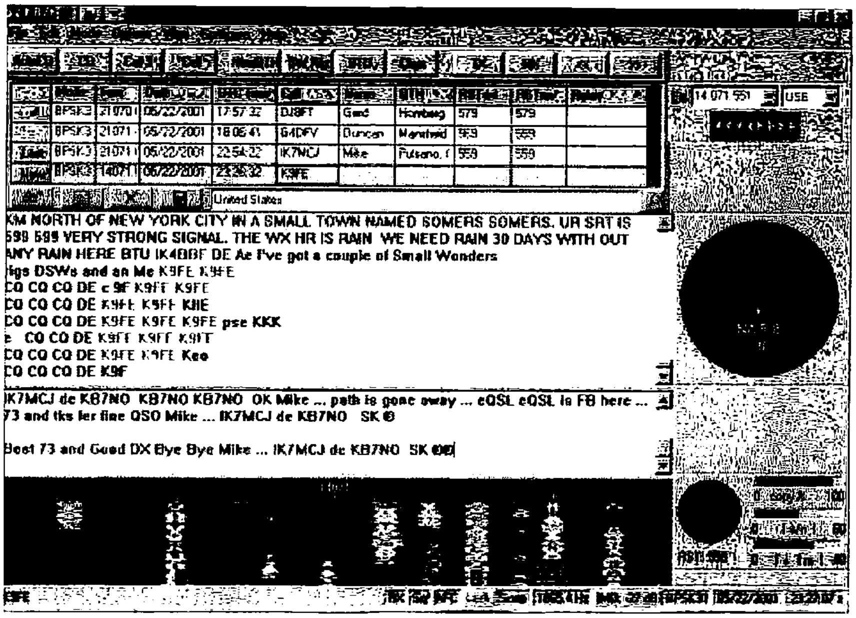

Fig. 1. Screenshot 1 — This is a basic view of MixW version 2 with about half the bells and whistles displayed. On the right side are three groups, including the world map and the tuning indicator at the bottom right. Due to the low resources available in my computer, I do not usually display the lower two (optional selections from the "View" pull-down). But you will be interested in the great guideline offered by the "RST" reading in the corner. That shows the "honest" appraisal of the K9FE signal at 559. Plus, if you look at the box at the bottom, the IMD is reading a respectable –27 dB. Not much left for argument — well, maybe. After I double-clicked on the callsign in the receive window, it was entered in the log cell. If he had been worked previously or was on my slightly ancient QRZ! disk, the name and QTH cells would have been filled in. If it were a previous contact, it would have been posted in the line just below the log where "United States" is showing. Users of previous MixW software will recognize the map which displays the direction to point the beam for the callsign as entered. The program provides control for automated rotators and would have activated that feature if it were present. Note there are ten obvious signal traces and this is during late afternoon on a Tuesday. The rig control is functioning. MixW calculates the frequency according to the rig readout plus the additional frequency where the trace was clicked in the tuning screen. You never have to calculate again. By going to the upper right tuning indicator, I can change bands, frequency, mode, and sideband, and the Icom rig responds immediately and correctly. At the time of this writing, most popular rigs were doing the same. The program will automate just about everything around the shack (no automated coffee pot yet). Easy and intuitive to use.

The other surprise entry is MT63. That being a mode I don't see much of at this end of the country, I have not been able to check it out, but I understand that the European hams are enjoying the mode. I would like to see it work on this computer because that is one for which the original software seems to approach my limitation of resources. I am sure I will have seen it work before next month rolls around.

In the midst of writing this column, I happened to tune 15-meter PSK31. This was during May, midmorning in the western U.S., and there was considerable activity with strong traces on the waterfall. I started to pay attention and to make a short story of the experience, I worked five European stations in that mode, one after another.

This does not necessarily reflect on a great program or operator so much as the fact the digital modes, especially PSK31, have come into their own worldwide. As the saying goes, "Everybody's doing it." What that really signals is that it is time to get really serious about what is happening in

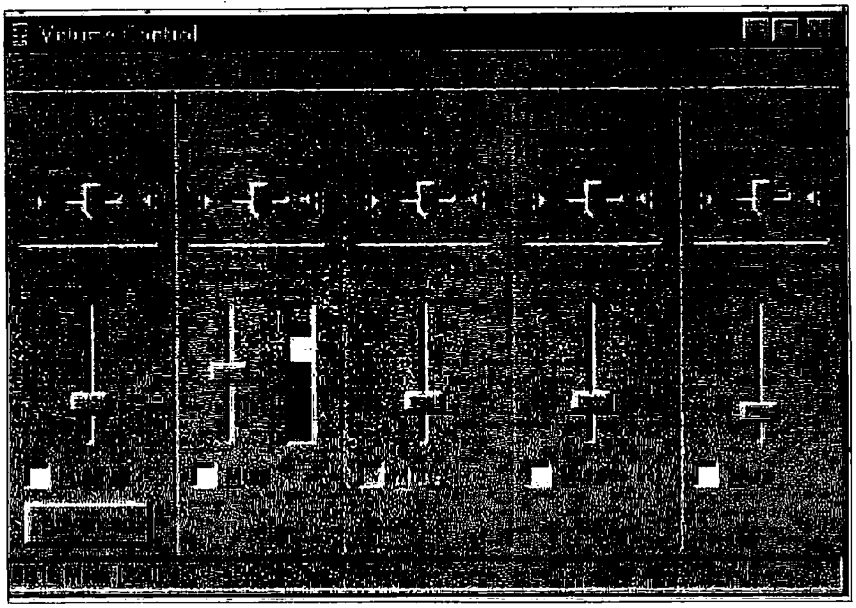

Fig. 2. Screenshot 2 — Here is a working view of the "slider panel" described in the text. Some form of this panel pops up when you double-click the speaker icon on the lower right corner of Windows 95 or 98. The bars next to the second slider from the left identify the control I use, during transmit, to set the Line-Out for transmit. I usually leave the left slider in about this position, though similar results can be had by its use. The most pertinent reference in the article is to the slider at the right. This makes or breaks the tuning window (waterfall) for MixW2. See the text. This panel can be useful regardless of your hookup. I use the bare-bones cable connections from the accessory port to the soundcard and get excellent reports when I get these "knobs" adjusted properly.

ham radio and where it is happening — right here in Digital Land.

What other modes can you work? Well, I could not believe how easily this worked, but I tuned to one of the HF packet bulletin boards, determined its callsign, and asked for a connect. It answered! Nothing hardly to configure. Insert a few callsigns and click.

So just to be sure it was really working, I practiced some of the calisthenics of logging onto to a ham bulletin board and it registered me as a user. By comparison, a few years ago, I attempted to get another system to work packet with a soundcard and never really got it all together. This is just too easy.

To tell the truth, I was thinking, as I did this, about a little nostalgia. Perhaps I might run across a ham to do HF packet keyboard. Didn't happen, but some of the friendly messages being up- and downloaded from the bulletin board sounded a bit like they were live. That was what reminded me of the days of yore.

MixW2 only copies Pactor, no transmit, but I was tuning across a 40-meter Pactor signal and decoded it to find something many of us may be interested in. Someone was receiving their personal E-mail via Pactor from a server on the Internet. I read about this a while back and have been going to research it and tell you my findings. May just get to it now. Anyway, the print was nearly perfect as the Pactor was copied. Of course there is no link, so the print isn't apt to be totally perfect. The mode is Pactor Listen.

Pactor ARQ (linked transmit) will probably never be available in MixW in any version because there Is some copyright provision that would have to enter into the cost at the user's end. But it is something most of us can use these dusty old multimodes for to keep them limbered up.

Speaking of multimode controllers, the MixW2 comes with a macro file to address the KAM multimode unit so that you can use your KAM with your MixW2 in terminal mode to work the other modes of your choice and take advantage of the log built into the software along with the other amenities.

I am going to see what it will take to get this to address the PK-232MBX sitting here. There just wasn't time to work that out as yet, and that is a whole 'nother story anyway. But there are a lot of possibilities, as you can see.

Speaking of the log, there are full import and export utilities with the program and it works. I imported the log file from the Logger program in just a few minutes. So now when I double click on a callsign in the receive window, I not only place the callsign in the macro-ready cell, but a search is made for a previous contact as well as search of the QRZ! disk in the CD drive.

And that CD search is at least as fast as if using the QRZ! overlay, especially the first time. Somehow, the access is just short of lightning-fast. I couldn't get this feature to work until I found the folder on the CD to point the MixW2 toward. Now it works like a charm.

Why do you need this?

I suppose you should have this program because I said it is good, but that is hardly a fair case to present. A better reason is because it is going to be the standard that other soundcard software is compared to. What I appreciate is its small physical size. I use that as a measure of quality programming. Enough said on that front.

The good points have pretty well been enumerated above. I would have liked to see it run to its fullest potential on this outdated computer. However, with the cost of computer components receding with the economy, I may just have a high horsepower board in this old girl as soon as the end of 2001. Now, that is saying something! Probably by the time I have risen to the 500 or 700 MHz level, I will still be so far behind the times that I will continue to be ribbed about the Commodore C64 in the shack. (It is actually in the garage. Need some sort of backup, you know.)

The cost of this shareware is insanely low. Unless I am mistaken, they are still selling registrations for $50. It isn't exactly a get-rich scheme. If I had the talent to do this, I would be doing something that paid very well for my time. But then, we are lucky to have Nick who does this sort of thing because he is a ham.

Specific adjustment note

In other related areas, I sometimes realize the "simple" things can bog us down. I don't think I have ever put in writing in this column how to adjust the audio into your soundcard. There are several options. The easiest is to use one of the store-bought interfaces and follow the instructions.

I use the bare-bones home-brew approach between the soundcard and the accessory port on the Icom. These hookups are described in detail in the Help File for MixW2. This simple circuit where you do not use an attenuator and go directly into the accessory port on the radio is a little trickier but doesn't have to be.

Source for:	Web address (URL):
Mix W Soundcard program for PSK31, RTTY, new modes, MTTY, FSK31, more	http://tav.kiev.ua/~nick/mixw2/ www.nvbb.net/~jaffejim/mixwpage.htm
FREE MMHam site — MMTTY — MMSSTV	www.geocities.com/mmhamsoft/
FREE VK7AAB — SSTV-PAL — PSK-PAL	http://users.origin.net.au/~crac/
Much ham info w/SSTV downloads	www.conknet.com/~kb1hj/index.htm
TrueTTY — Sound card RTTY w/ PSK31	www.dxsoft.com/mitrtty.htm
Pasokon SSTV programs & hardware	www.ultranet.com/~sstv/lite.html
PSK31 — Free — and much PSK info	http://aintel.bi.ehu.es/psk31.html
Interface for digital - rigs to computers	www.westmountainradio.com/RIGblaster.htm
Soundcard interface info — includes Alinco	www.packetradio.com/psk31.htm
Interface info for DIY digital hams	www.qsl.net/wm2u/interface.html
WinWarbler info and free download	www.qsl.net/winwarbler/
MFSK-related tech info — how it works	www.qsl.net/zl1bpu/
Throb — New — lots of info	www.lsear.freeserve.co.uk/ www.btinternet.com/~g3vfp/
Download Logger, also Zakanaka	http://www.qsl.net/kc4elo/
PSKGNR — Front end for PSK31	www.al-williams.com/wd5gnr/pskgnr.htm
Digipan — PSK31 — easy to use	http://members.home.com/hteller/digipan/
TAPR — Lots of info	www.tapr.org
TNC to radio wiring help	http://freeweb.pdq.net/medcalf/ztx/
ChromaPIX and ChromaSound DSP software	www.siliconpixels.com
Creative Services S/W Multimode w/PSK	http://www.cssincorp.com/products.htm
Timewave DSP & AEA (prev.) products	www.timewave.com
Auto tuner and other kits	www.ldgelectronics.com
XPWare — TNC software with sample DL	www.goodnet.com/~gjohnson/
RCKRtty Windows program with free DL	http://www.rckrtty.de/
HF serial modem plans & RTTY & Pactor	http://home.att.net/~k7szl/
SV2AGW free Win95 programs	www.raag.org/index1.htm
Source for BayPac BP-2M & APRS	www.tigertronics.com/
Int'l Visual Communications Assn. — nonprofit org. dedicated to SSTV	www.mindspring.com/~sstv/
Hellschreiber & MT63 & MFSK16 (Stream)	http://iz8bly.sysonline.it
HamScope — multimode w/ MFSK16	http://users.mesatop.com/~ghansen/
YPLog shareware log — rig control — free demo	www.nucleus.com/~field/

Table 1. The Infamous Chart.

Here is what I do. Go to the lower right of your regular Windows monitor screen, find the speaker icon, and double-click on it. If you single-click, you will only get to adjust the speaker volume (which can do the job for Line-out most of the time), but the double-click displays a whole panel of slider controls for the soundcard drivers.

All Windows systems do not have the same panel. I have two versions of Windows95 and one of Windows98 and all three are slightly different. What is fairly consistent is that the significant slider when in transmit mode will have some red, yellow, and green colors displayed next to it. In the case of the panel I view with this computer, I can simply tweak that slider until the ALC stays at zero. The slider in this case is named Wave. Refer to **Fig. 2**. (Sound strange? Read on.)

Naturally, there must be a fly to creep into the ointment during this process. The seemingly same results can be obtained from simply adjusting the slider named Volume. However, I usually leave the "volume" slider up about one notch from the bottom on these systems and give it the final tweak with the one with the colors. This results in very good reports. That counts a lot for popularity in digital modes. Wide signals equal crabby hams — no fooling.

Incidentally, I often find it prudent to adjust the RF power at the rig after the above steps in order to lower the heat. In my case, it is too easy to hit 80–90 watts out. Not only is this power not needed, but it can shorten the life of the finals.

The audio going in the other direction that you are going to receive can be adjusted with a more readily identifiable slider in the panel, in this case named Line-In. One of the reasons I bring all this to your attention is because this is a frequent cause for query and I don't think I ever put this much detail in the column about it.

It is even helpful to know these things if you are using one of the many store-bought, plug-and-play interfaces. I like those. They get a lot of hams on the air quickly and painlessly, but the part I was mentioning about the receive audio may be of use for many of the interface users because:

The MixW2 has something a little different from the average software in the receive spectrum. It is more sensitive and does not have a good readable pattern until you back off that "Line-In" drive. I went the other way at first and thought there was something more wrong with the old computer here.

Then I started watching the reflector and found that others were complaining about reading the waterfall. The final revelation was the sensitivity issue. With MixW2, it is necessary to run that last-mentioned slider near to the bottom of the scale, and you will be amazed at how well the waterfall works.

I think that is about all the editors of this magazine will allow for one installment. There is more. You just need to get in there and see how it works for you. Every setup seems to be a bit different according to what I see on the reflector, but I don't think there is any combination that does not work.

Every now and then someone will send me a question about a slightly different computer configuration, but there is usually a way to make these computers talk to our radios. Some do it more easily and some have slightly better results, but just about everything works with an application or two of logic and patience.

If you have questions or comments about this column, please E-mail me at [jheller@sierra.net]. I will gladly share what I know or find a resource for you. For now, 73, Jack KB7NO.

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Bringing RDF and Amateur Radio to Teens

"Ham radio needs more young people." "Early exposure to ham radio leads to a successful career in high-tech." "Using ham radio activities, learning about science is fun for kids." Almost everyone agrees with these statements. Let's meet some hams that have taken them to heart.

To get youngsters excited about Amateur Radio, there's nothing better than on-foot hidden transmitter hunting, also called foxhunting, foxtailing, radio-orienteering and ARDF. It combines plenty of good physical exercise with the technical challenge of using radio gear. There's the intrigue and adventure of discovering hidden objects, plus the challenge of navigating with a map and compass.

"Homing In" has covered my efforts to bring ARDF activities to Scouts and the schools, most recently in the January issue where I described last year's Jamboree-on-the-Air (JOTA) demonstrations. There's an article at my Web site with more ideas for JOTA fun with radio direction finding (RDF). If enough local ham clubs would get involved, including yours, every Scout troop and classroom could experience the fun of foxhunting.

Unfortunately, when I talk to hams who are Scout advisers and schoolteachers, most of them say that they can't do it because of lack of funds, bureaucracy, and so forth. Oh really? This month, the spotlight is on two California hams with a "Never Say Die" attitude that made it happen. Next month, we'll visit some Texans who are achieving the same goals in different ways.

Photo A. Mark Hayden KF6DSA, an assistant professor at Pasadena City College, was organizer and primary instructor for this foxhunting project.

Foxhunting in the Classroom

Mark Hayden KF6DSA (**Photo A**) is a relatively new ham, but he's an old hand at educating young people. "During the week, I teach life science, physical science, algebra, and arithmetic in a high school program at the Community Education Center of Pasadena City College (PCC)," he says. "Most of my students are 18 to 25 years old. They've been out of school one or two years when they realize that they need a high school diploma or certificate."

Mark's interest in ham radio was long-standing, but didn't come to the forefront until about 8 years ago. "I got a grant from a foundation to set up a satellite receiving station at the last school where I taught. Two NASA technicians came out and put in antennas for GOES and polar weather satellites. One was a ham radio operator. He encouraged me to finally get my ham ticket."

KF6DSA saw an opportunity to use our hobby to enrich young people through the NASA Pre-college Science Academy (PSA). "This program gives teens opportunities to improve their math and science in school through extracurricular activities," he says. "And it fosters their interest in science and technology."

NASA-PSA activities are open to all 7th and 8th graders in the Pasadena Unified School District who have scores of 85 percent or higher on Scholastic Aptitude tests in math and reading. They also must be recommended by their school counselor or principal. "Disadvantaged" students are targeted for inclusion. Sessions are held almost every Saturday morning during the fall and spring school semesters. Two Family Forums per semester give parents a chance to get together with the leaders.

There is no charge to students and parents for NASA-PSA. Funding and technical support comes from NASA, the Jet Propulsion Laboratories (JPL), Pasadena Unified School District, and California Institute of Technology (Caltech). In addition to enhancing their math, computer and engineering skills, students get exposure to state-of-the-art technologies such as USA's space program. Dr. Joe Conner, head of

Photo B. *Phil Barnes-Roberts AD6PQ, an Engineering Technical Assistant at Jet Propulsion Laboratories, optimized my offset attenuator design to make it student-friendly.*

NASA-PSA at PCC, is nearing his goal to fund a National Science Tour that will take the students on a trip to the Kennedy Space Center for a Shuttle launch.

Mark's first NASA-PSA project was in the spring 2000 semester. Each student built a simple 20 MHz receiver, the heart of a radio telescope for monitoring RF emissions from Planet Jupiter. Next, KF6DSA wanted to do a radio direction finding project, so he began studying catalogs and the Internet. In March 2000, as he was considering some commercial RDF kits, he attended a Pasadena Radio Club (PRC) meeting where I gave a program on T-hunting and radio-orienteering.

KF6DSA asked for my help in organizing some transmitter hunts for the students. We discussed appropriate equipment and concluded that simple yagi/attenuator/scanner setups would provide just the right technical challenge for the students, at a budget-friendly cost. Unlike the time-difference-of-arrival RDF kits he was considering, yagi-based systems are effective with any signal polarization, give amplitude (relative distance) as well as direction information, and are more sensitive.

For technical support, Mark called on fellow PRC member Phil Barnes-Roberts AB6PQ (**Photo B**). "At JPL, he subjects components and circuits to high frequency radio energy," Mark explains. "He's very knowledgeable." Phil would handle details of the student construction projects, gathering the parts and making kits for the attenuators.

Mark's proposal won Dr. Conner's enthusiastic approval. Funding was provided for yagi/attenuator parts and VHF/UHF scanner receivers, to be retained by the program afterwards. Yagis would be the steel-tape type, from plans by Joe Leggio WB2HOL. Offset attenuators would be based on the design at my Web site. Sessions would be in Mark's classroom at the Community Education Center, about two miles from the main campus.

Attendance at the spring 2001 semester was greater than before because some participants in the Upward Bound program joined in. Upward Bound is funded under federal TRIO programs by the US Department of Education, with the goal of increasing rates

Photo C. *At the equipment testing session, students discovered that it's hard to take bearings while carrying a yagi, attenuator and receiver separately. After that, we decided to put handles on the yagis and mount the attenuators to them.*

Photo D. Some of the completed steel-tape RDF beams with attenuator boxes mounted to the handles, ready for the hunt.

Photo F. It's in the tree! NASA-PSA students discover one of the practice transmitters and mark their frequency sheets with its orienteering punch to prove that they found it.

at which teens enroll and graduate from colleges and universities. Students must either be from low-income families or be potential first-generation college students.

On the first class day, Mark and I introduced a room full of eager youth to the world of RDF. We showed them how hams use it for fun (T-hunting and radio-orienteering) and for serious purposes (tracking accidental and deliberate interference). We told them about other important RDF uses, such as finding downed aircraft with Emergency Locator Transmitters. Mark gave each one a 3-ring binder full of articles about direction finding, Amateur Radio, and the projects they would be building.

Photo E. A student programs the fox frequencies and associated offset frequencies into his scanner.

That was the last time I saw the students for several weeks. Their next session was a tutorial on soldering and construction techniques by Naomi Garcia, a PCC vocational instructor. After that, they set to work on their RDF equipment under the guidance of Mark and Phil.

AD6PQ modified the attenuator layout to fit in a larger plastic box, making construction easier. "For safety and consistency, we drilled the attenuator cases before the students got them," Mark explains. "We also pre-cut the perf-board and drilled holes for potentiometers and BNC connectors. Everything else was done by the students. They built the antennas completely by themselves, including cutting the PVC pipe and the tape measures."

Hunt Day Arrives

I considered some large parks and recreation areas near Pasadena for the NASA-PSA ARDF sessions, then discovered that the main PCC campus is perfect. It has plenty of flower beds and shrubs to provide concealment. The buildings provide just enough multipath and signal blockage to make it a suitable challenge.

For the students' first radio-orienteering experience, I put out three practice transmitters, to be followed by a 5-fox course with international-rules timing (each fox on for 60 seconds, in sequence). The practice foxes were concealed but within 100 yards of the Sculpture Garden start point. The other five were scattered throughout the 53-acre campus.

It took a few minutes' practice for students to learn how to hold their antennas straight out, not pointed up or down unless they thought that the foxbox was in a tree or on the ground right next to them (**Photos C** and **D**). The scanners bought by the program didn't have S-meters, so the teens soon figured out how to use FM signal quieting to determine the direction to the hidden transmitter. They got the hang of tuning 4 MHz up or down to the offset frequency when the signal got strong, increasing attenuation as they got closer, and estimating distance from the setting of the attenuator (**Photo E**).

Once they gained some confidence in their RDF abilities by finding the practice foxes (**Photo F**), they were ready for the main hunt. April WA6OPS timed them individually as off they went on their first

Continued on page 62

By Eric Shalkhausser W9CI, SK

The History of Ham Radio

Parts 9 and 10: Portable and mobile, more experimenting.

In the early 1920s, in order to be truly portable a radio receiver had to be fairly light in weight, have a degree of efficiency, and be designed so that it could be moved about with ease. It was dependent, above all, on some type of portable antenna. Reliable operation and portability were the basic criteria.

The antenna was of the loop type, of modest dimensions, and foldable. Dry "A" cells were the only source of sufficient current required for the filaments of the vacuum tubes. The plate supply depended on "B" batteries. The batteries contributed the major weight. The older UV 200 and UV 201 tubes were replaced by UV 199 and the WD11 tubes which did not require as much filament current, thus lengthening the operating life.

Using a loop for reception posed somewhat of a problem. The loops used had distinct directional characteristics. A loop had variation coverage as much as five to one forward compared to the sides. During the summer months, general activity among radio amateurs was not only down, but rather drab and unenthusiastic. QRN and static prevailed with regularity, and activity was carried on the assigned wavelength of 200 meters (plus or minus).

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The broadcast listeners had the evening hours with little or no amateur QRM to contend with. The agreed upon hours of silence were regularly observed by the amateurs. Summer activity was usually looked upon as putting a damper on most ham transmitting. It was a time to take inventory of equipment to rebuild and update for the coming winter season.

Whenever radio amateurs were involved in a project, ingenuity prevailed. A.H. Grebe, the well-known inventor and manufacturer of the CR line of receivers known and used by most amateurs during the twenties, went portable in a big way by giving the loop advocates an eyeful. He preferred to stay with the usual design—flat top, multiwire model—in spite of the limited cruising mobility (**Photo B**).

The aerial with autobody-counterpoise configuration was preferred over a loop to avoid specific directivity. When ready to dismantle the outfit, what did Mr. Grebe devise? The entire overhead system was slung under the running board (cars had large running boards in them days) on hooks provided for that purpose. Instead of using dry cells, a storage battery was available for the heavy drain required for the tubes.

Photo C illustrates what was available for radio entertainment while visiting the famous boardwalk at Asbury Park, NJ: the Roller Chair Special. The apparatus consisted of a radio chair so compact that three persons could sit comfortably side by side in the seat. A loop of the flat type was connected to the detector-amplifier held in the laps of the travelers. No coils were used, all tuning being accomplished solely with the variable condenser. Signals from stations over 200 miles distant were heard. Such sets were effective for wavelengths of 300 to 500 meters, and good results were often had at wavelengths up to 800 meters.

A more practical and somewhat more compact, all-around enclosed model of portability consisted of a receiver using a popular circuit known as a Grimes "Inverse Duplex" (**Photos D** and **E**), having four tubes of the WD11 type. The set had a wavelength tuning capability of 200 to 3500 meters. The particular instrument shown in **Photo D** was transported to the Philippine Islands in 1924 and served a lumber mill owner for years. It traveled


THE AUTO RADIOPHONE

By A. H. GREBE

Photo A. *A.H. Grebe's portable rig.*

by motorboat and other sundry conveyances over the broad island and mainland areas, giving the owner contact capability with his home base. The receiver was used in connection with a kW spark transmitter.

Legislation Problems Unsolved

The very rapid expansion of radio broadcasting during 1922–1923, together with the great demand for receivers and the need for some semblance of interference control, pressured legislators in Congress to come up with an urgent solution. The folks back home demanded action.

As a result of the first radio conference, held in Washington in the spring of 1922, Congressman White of Maine introduced a bill known as the White Bill, HR 11964. For almost a year thereafter the bill was periodically under discussion, often under review, but constantly in the minds of the radio amateur.

On January 2, 1923, almost a year after the White Bill was introduced, the ARRL President, Hiram Percy Maxim, went to Washington for a hearing on the bill. He was instrumental in bringing to bear on the legislation the opinions and recommendations of the amateur fraternity. It was the ARRL up in front, promoting action and showing great interest in bringing about an equitable solution to the problems confronting listeners, the broadcasters, the commercial operators, and the thousands of amateurs. But speaking in behalf of radio amateurs in particular, it was Mr. Maxim's foremost objective to ensure that amateur radio would continue to have its rightful place.

The White Bill contemplated legislation to broaden the wave band for broadcasting so that the service could grow, expand, and perform in an orderly fashion, an action that was required so that Secretary of Commerce Hoover could be given authority to properly regulate radio in the United States. The bill was carefully analyzed, several

Photo B. *A good view of Grebe's portable antenna system.*

Photo C. *The Roller Chair Special.*

recommendations and amendments were proposed, and suggestions were offered in an attempt to bring the listener and the radio amateur into accord. It was hoped that commercial interests would not be the dominating influence in this free and open domain, the ether.

However, in the end, what happened?

The White Bill, HR 11964, passed the House on January 31, 1923, went to the Senate, and there was referred to the Committee on Interstate Commerce. Because of considerable outside opposition to various provisions, the bill languished and finally remained to die with the expiration of the 67th Congress on March 4, 1923.

Sensing trouble, and knowing the general attitude taken by many interests in the bill, White introduced a new bill on January 11th, with certain modifications proposed. It included provisions somewhat more palatable to the objectors. The new bill was introduced as the White-Kellogg Bill. It also died in the face of considerable opposition. This virtually ended the hopes of all concerned to patch up the old 1912 radio law and bring order out of a simmering and ongoing chaotic situation.

On March 20, 1923, Secretary Hoover called his Radio Telephone Conference members to review the situation, hoping that a solution could be found to administratively cope with a defiant muddle. It was paramount that a way be found to open up more wavelength channels for broadcasting. The second National Radio Conference thus came to order.

In the meantime, amateurs, again caught in the middle but constantly cooperative, commanding the staunch support of the Secretary, had devised a so-called "Rochester Plan." The plan specified that in communities where QRM would be considerable and above normal in volume, quiet hours would be observed between 7 and 10:30 in the evening in all zones throughout the country, especially in the more heavily populated areas. At the conclusion of this second conference and after months of deliberation, a schedule evolved and was recommended. (See **Table 1**.)

Amateur activities on the rise

Amateurs were beginning to discover, through their constant experimenting, that wavelengths below 200 meters had possibilities not to be denied. The vacuum tube and the associated circuitry developed led the experimentally-minded amateur into unexplored fields. He discovered that by using vacuum tubes instead of spark gaps he was able consistently to span distances with ease and much less

Photo D. *A portable receiver which used the Grimes "Inverse Duplex" circuit. Starting in 1924, this particular set was used for many years by a lumber mill owner in the Philippine Islands.*

Photo E. *The power pack contributed the major weight to these portable units.*

power on his assigned wavelengths. Dropping down below 200 meters had tremendous possibilities. All of the early tests engaged in between individuals in various parts of the country were usually planned in advance and followed a schedule. Practically no one was listening below 200 meters. Nobody had a receiver at this state of radio progress, nor the capability to tune down much below 200 meters. With no signals on the air except by prearrangements between individual operators, there was only static to be heard. The ether was just an empty void below 200 meters and was generally avoided.

Below 130 meters	Available for special licensing
130 meters	Government, CW, exclusive
130–143 meters	Available for special licensing
143 meters	Government, CW, exclusive
143–150 meters	Available for special licensing
150–200 meters	Amateur, CW, ICA, phone, spark, exclusive
200–222 meters	Special amateur, technical & training schools, CW, exclusive
222–231 meters	Aircraft, CW, ICW, phone, nonexclusive
231–286 meters	Class B broadcasting, phone, nonexclusive
286–288 meters	Reserved
288–300 meters	Class A broadcasting, phone, exclusive
300 meters	Marine, CW, ICW, spark, nonexclusive
300–450 meters	Class A broadcasting, phone, exclusive
450 meters	Marine, CW, ICW, spark, exclusive
450–545 meters	Class A broadcasting, phone, exclusive
545–674 meters	Marine & aircraft, CW, ICW, spark, exclusive
674 meters	Government, CW, nonexclusive
674–800 meters	Marine & aircraft, CW, ICW, spark, exclusive
800 meters	Radio compass, CW, ICW, spark, exclusive

***Table 1.** Schedule evolved from the 2nd National Radio Conference. Class A and B broadcasting stations were assigned a wave band of 10,000 cycles, none closer together than 20 kilocycles in frequency. Within each area zone there would be ten stations separated by 50 kilocycles.*

As the amateur slowly ventured into the lower unexplored regions, he faced one common question, namely, "Will the efficiency of the tubes I have available decrease as the wavelengths become shorter?" He knew that the larger tubes were still quite inefficient in design and the circuitry lacking in development. Many amateurs could not be convinced that "below 200 meters" was a fertile field in which to risk expensive "bottles." This area also was unsuited to the tuners used, and besides … the antenna he was using was too long, and nobody could be heard with whom to communicate. The League at Hartford had a great deal of convincing to do and a great many illusive misgivings to overcome among the majority of hams. Most amateurs were unwilling to let down their old multi-element aerials, disconnect the ammeter from the antenna lead, or trust the plain Hartley transmitter circuit. There was still an amount of extraordinary experimenting ahead.

Wavelength vs. frequency

Another major stumbling block in the way of progress was evident. This was the fact that nobody knew or was seriously concerned about how to make wavelength measurements. Up to this time, very little reference had been made to the term *frequency*, nor much attention paid to conversion from wavelength to frequency. Conversation among radio men held rather tenuously to *meters*. Not until the League convinced the radio division of the Bureau of Standards that by transmitting measured frequencies over their Washington station, WWV, for amateurs to copy and adjust circuits to conform to, would the ice be broken. So, from this time on, the wavemeter gradually became the most important laboratory instrument in the ham shack. Schedules were now arranged to have transmissions from WWV appear periodically, set for eleven p.m., EST on specified wavelengths and frequencies. They provided calibration settings for all home-built wavemeters, permitting the receiving tuners to be modified, rebuilt, or redesigned for receiving the higher frequencies. A new and important era in amateur radio was now set in motion with vigor.

***

The Second Radio Telephone Conference, called by Secretary Hoover, convened on March 20, 1923, to solve the deplorable situation brought about by the controversy over wavelength assignments. Broadcasters, the amateurs, the Army and Navy, the ship operators, and the commercial interests could not come to a common agreement as to wavelength allocations and thereby avoid woeful interference. Clearly, from an administrative standpoint alone, the broadcast listeners were desperate. The impasse which existed required a solution.

After several months of meetings, serious discussions and lengthy deliberations, not even the amateurs had guidance or a clear go-ahead on how to interpret their standing with the Commerce Department. The American Radio Relay League had made a series of suggestions. The amateurs in all parts of the country, now almost 21,000 in number and licensed to operate in the narrow 200-meter range, found solace in the fact that they had pooled their ideas and suggestions through their respective district directors.

The ARRL Board of Directors based high hopes on all of these inputs. So, when recommendations were issued on June 28, 1923, by the Department of Commerce in the form of General Letter #252, directed to all government district radio inspectors, they read as follows:

C.W. Licenses

DO you fellows know that your station license provides that the apparatus described in the application shall not be changed without permission? And that a license granted a spark station is not good for the use of C.W. equipment? It sounds queer, considering that any complaintant ought to prefer a tube set to a spark, but if anybody wants to "get" you on it they can.

A broadcast listener recently filed a complaint with a radio inspector against a well known eastern spark amateur, alleging the use of an illegally broad and too-long wave. Called upon the carpet, there was no evidence that his spark, which was good as such animals go, was not entirely legal. But he volunteered the information that he was experimenting with C.W. anyway and the interference probably would be still further reduced. Whereupon, altho his spark set was O.K., he was informed that the use of C.W. was in violation of his license, and it was suspended for three months.

Moral: If the equipment you are using is greatly different from that for which your license was issued, take up the matter with your Inspector and "get right."

QST - March, 1923

Photo F. *A notice from* QST, *March, 1923, warning against using spark rigs for CW.*

"General and Restricted Amateur Radio Station Licenses will be issued permitting the use of any type of transmitter (CW, spark, ACCW, ICW, SC, and phone) with the restriction that when using pure CW, they are authorized to use wavelengths from 150 to 200 meters. When using spark, ACCW, ICW, unfiltered SC, and phone the wavelengths from 175 to 200 meters only can be used. The types of transmitters must be specified in the application and the license.

"Special Amateur Radio Station Licenses will be issued permitting the use of pure continuous wave transmitters only, authorizing the use of wavelengths from 150 to 220 meters.

"For the purpose of application of Amateur Stations, pure CW is defined as follows: A system of telegraphing by continuous oscillations in which the power supply is substantially direct current as obtained from (1) a generator, (2) a battery, or (3) a rectifier with an adequate filter. (A filter is not deemed adequate if the supply modulation exceeds five percent.)

"On licenses issued for Amateur Stations you will include the following: 'This station is not licensed to transmit between the hours of 8:00 and 10:30 p.m., local standard time, nor Sunday morning during local church service.'

"Special Amateur Stations must be operated by persons holding an extra first class grade Amateur operator's license, or a commercial extra first class operator's license. Applicants must also meet the requirements of Regulation 63.

"A new class of Amateur operator's license is hereby established, to be known as 'Amateur Extra First Grade.' Licenses of this grade will be issued to persons passing the required special examination with a percentage of at least seventy-five and code speed in sending and receiving at least twenty words per minute, five characters to the word; who have had at least two years experience as a licensed radio operator; and have not been penalized for violation of the radio laws subsequent to the date of these regulations."

The government supervisors, located in the several United States radio districts, upon receiving the new regulations, were requested to notify all amateur radio licensees, general and restricted, to submit their respective license papers to the supervisor's office and have them modified in accordance with the new regulations. After they were so certified with a copy of the new rules appended, they were returned, officially endorsed, extending the wavelengths range and specifying the quiet hours. No changes were made in their expiration date.

All amateurs who held *special* licenses were notified that their licenses were canceled and new licenses would be issued in accordance with the new permits now granted. Up to the present, all amateur licenses were issued specifying the wavelength of the operating transmitter to be used. From this date on, a license permitted a station to change the operative wavelength to accord with the bandwidth permitted and as the type of emission specified.

Variable frequency transmitter circuits were not generally known among amateurs. The progress of the art and the know-how was still lacking in 1923 in this respect. Even the well-informed and up-to-date amateur solved the changing frequency problem by having more than one transmitter available, usually a pure CW of low power and another with either ICW or ACCW plate supply. Every license issued by the Commerce Department required that the licenses specify not only the wavelength limits of the transmitter, but also the emission type and the apparatus to be used, including the

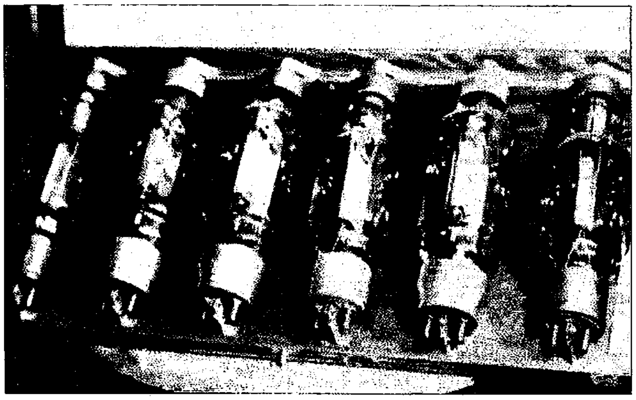


Photo G. *The 250-watt UV204.*

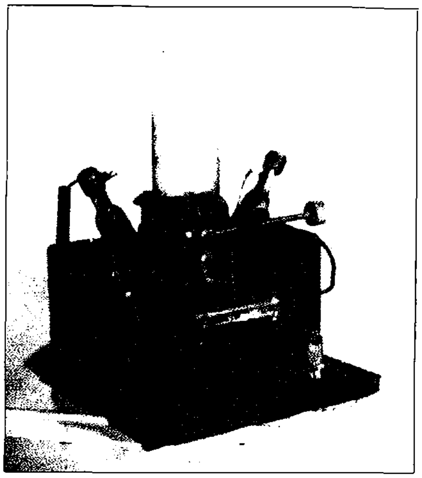


Photo H. A one-kilowatt transmitter.

antenna length and construction. If an amateur qualified as an extra grade operator, he could apply for two licenses, a special and a general. The special was then given a "Z" call.

The ARRL had recommended that the amateur with two years of experience and a twenty-words-per-minute code speed be issued an extra first grade amateur operator's license using a wave transmission length up to 220 meters. (Even at this date all authorities assumed that this stipulation was a decided advantage for DX.)

It also was understood that transmissions on wavelengths other than 200 meters by the amateurs could be allowed on the issuance of a license specifically noted on the application. A second wavelength, perhaps somewhere between 175 to 180 meters, could be granted. The 150 to 220 meter band specified in the 1923 Regulations gave the Secretary authorization to grant licenses upon request provided the amateur could meet the stipulated requirements and so requested in his application.

How the need for "plate" power was met

In the early wireless days, the conversion from simple spark coil to high voltage rotary-gap transmission was not difficult. But going over to the vacuum tube for CW operation was by no means an overnight accomplishment. To put continuous wave power into the antenna, the amateur initially had available a small amplifier tube and a larger five-watter, known as the UV202. Subsequently the fifty-watt 203 was available, followed soon by the 250-watt UV204, a real "powerhouse" for most DXers (**Photo G**).

With the introduction and development of the power tubes, there naturally was need for a direct current supply to energize the plate circuit. Much of the spark gear the amateur had accumulated and used for a power source was now destined for the surplus stockpile. The new regulations specified pure CW or nearly so, and this necessitated some type of direct current source, often up to several thousand volts. Various methods to obtain this voltage were outlined in the ham literature: (1) a motor generator, or (2) a battery, or (3) a type of rectifier with filter. Much experimenting took place. This voltage was referred to as the "B" voltage supply

The Motor Generator

Although not the most practical source of high voltage DC nor the least expensive, a generator was the easiest and simplest way to quickly come up with plate power of one- to two-thousand volts. The ESCO machine from Electric Supply Co., of Stamford CT, could be found in many ham shacks. Early commercial broadcasters also used this equipment. However, the supply required filtering to reduce the ripple modulation to a point where it would meet the specified five percent. Using a motor generator required AC starting controls, considerable power wiring, and usually a remote and out-of-the-way installation of the entire

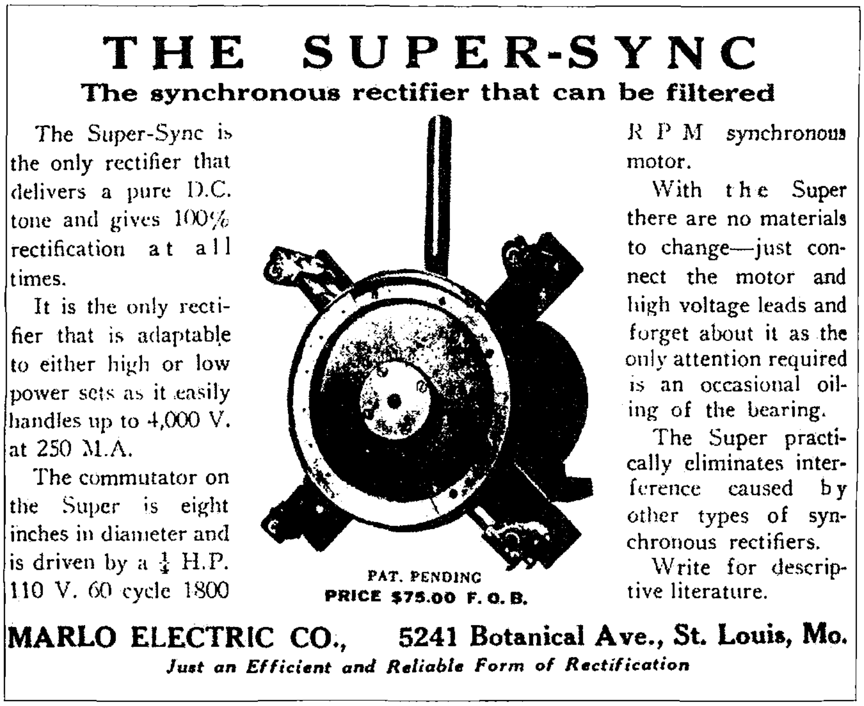
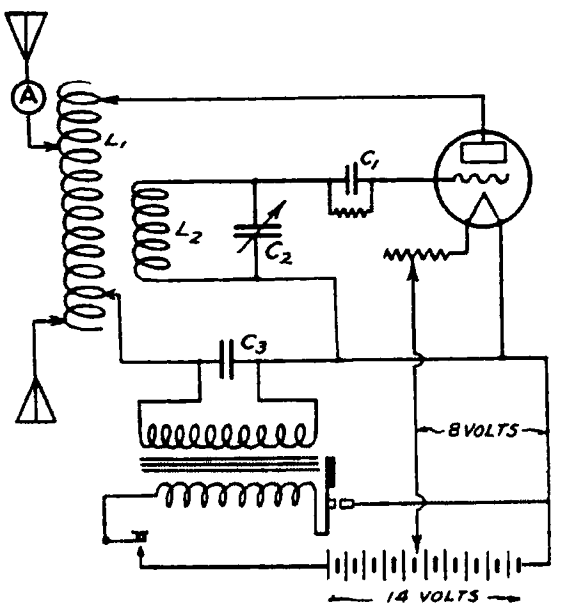


Photo I. A synchronous rectifier.

With a half inch spark coil a hard receiving tube may be used; either the Cunningham C.301 or the Radiocorp U.V.201 is suitable. For larger coils the 5-watt C.302 or U.V.202 may be used but less filament power is consumed by the Western Electric "E" or VT-1 tube. No 50-watt tube with proper plate insulation for spark-tube work is available just now but the C.303 or U.V.203 can be made to do.

Various circuits have been described in our pages in a paper called "A Spark Coil C.W. set," by Samuel Kopelson of 2BCF (May 1922—p. 66), and in "A Spark Coil C.W. Transmitter," by F. J. L. Duffy (March 1922—p. 28). In *The Modulator* for January 1923 there appeared on page 17 a concise paper by M. Joffe describing his spark-tube set at 2BYO.

The best plan of all is to remove the secondary entirely and re-wind the coil with wire 6 or 8 sizes larger. Robert Kraus of 2CEI finds that for a Ford spark coil the best secondary is one having 5000 turns of number 32 A.W.G. (B&S) double-cotton-covered wire. When the secondary is re-wound in this fashion no shunt condenser is needed in Fig. 4 and even for the other circuits it can be reduced to .001 microfarad. Three sheets of 4 x 5 tinfoil between 5 x 7-inch glass sheets 1/8 inch thick is more than enough.



L1—25 turns bare No. 10 wire on a 5-½ inch tube.
L2—20 turns No. 18 S.C.C. copper wire on a 3 inch tube.
C1—Mica condenser of .00025 to .0005 micro-farads capacity.
C2—Variable condenser, .0005 microfarads.
C3—Glass or other sending condenser.

Photo J. Specially wound spark coils.

unit to reduce hum and noise when operating voice modulation. Weight and expense were responsible for the few installations of this kind.

Edison and lead-acid batteries

Edison-type batteries were available built in small but compact units. They were kept charged with a Tungar charger-rectifier connected to house current. The lead cells could be obtained in compact assemblies giving sufficient wattage for the smaller transmitting tubes. All these units were messy and, besides giving off a gas odor, ruined many floors and carpets.

Typical of what certain amateurs were capable of and determined to build is illustrated by the enviable installation of radio NU9BHT. This beautiful layout required assembling and building one thousand individual lead-acid cells. They were contained in 4-1/2" x 5-1/2" hard rubber cases, with one positive and two negative plates per cell. Hard rubber trays contained 25 cells each and were treated with acid-resistant paint to provide protection and longevity. With each bank delivering 50 volts, separate switches were used to make appropriate connections for charging each bank, either separately or in four bank series of 200 volts. A motor generator battery charger delivering 250 volts kept the batteries fully charged.

Installations of this type necessitated adequate ventilation, care, considerable service, and a separate building to house the equipment. the circuit diagram of the station transmitter adapted itself to frequent modifications and changes to keep it up-to-date.

With the development of crystal control and other experimental features added from time to time, NU9BHT established an enviable record while in service. Operating primarily on 40 meters CW and occasionally on 20, as an official ARRL relay station, it contacted all Australian districts, making five-continent QSOs in one evening. This was an exceptional accomplishment back in 1923. Not many installations of this type prevailed in hamdom. With a battery voltage source no filtering was required. This was *pure* DC!

The rectifiers, mostly chemical

Over the next few years, the various amateur publications carried a series of suggestions for methods of building rectifying equipment for the B supply.

How did the amateur go about putting together a chemical rectifier? He was on the lookout for—item one: chemically pure aluminum sheets; item two: chemically pure sheet lead; item three: a quantity of pint-sized jars; item four: several pounds of borax; item five: plenty of distilled water.

For each cell assembly he figured that approximately 40 volts could be rectified from a 60 cycle source. This translated to about 50 cells required for a 2000-volt output. Forming and placing such a home-built rectifier initially into operation required a great deal of experimenting to overcome a whole series of mishaps. Rectified AC output of this type was always

accompanied by a 60-cycle ripple hum, which had to be adequately filtered before it could meet the prescribed specifications—especially if it was to be used for a near-pure CW purpose. Filters were needed to eliminate key clicks. With batteries, there was complete absence of blinking lights, buzzing, whining, vibrating generators, and many AC growls on the air.

Other substitutes for B supplies

A convenient and inexpensive unit known as the mercury arc rectifier, equipped with an electrolytic "keep-alive" mechanism, was extensively used to give up to 3000 volts of B supply power. Both voltage and current outputs satisfied a one-kilowatt transmitter (**Photo H**).

Also available was a synchronous rectifier, as shown in **Photo I.** A synchronous motor, 1800 rpm, carried a large-diameter split wheel, with which two husky commutator brushes made contact. In this way, the 60-cycle current was rectified and the pulsating directional output then filtered. These units were marketed under the name of Super-Sync and provided plate energy rated at up to 4,000 volts.

Some of the early plate supplies were obtained from specially-wound spark coils—see **Photo J.** Such transmitter assemblies put out an ICW signal, were extensively used, and solved the high-cost problem. It was necessary to adjust the vibrator frequently to obtain a smooth tone, the pitch being immaterial but often adjusted to satisfy the contacted operator at the other end.

Radio amateurs in the early 1920s were an experimental and ingenious lot. They solved their problems in the best amateur tradition. 73

NEVER SAY DIE

continued from page 7

Well, what does that leave us? Diplomacy? Har-de-har.

One thing we've sure learned in the West is that money talks. Money from our big industries has total control of Congress and the White House. It was a slow, sneaky shadow win, covered carefully with propaganda (a.k.a. advertising and PR).

We suckers dutifully roar, running after the waving red flags like bulls, unaware that we're puppets being strung along. We're, and this includes most of Europe too, being manipulated. We're being entertained with baseball, football, soccer, basketball — with a media totally owned by the same group that's pulling Congress's strings, chasing after more entertainment for us. Like political campaigns or the latest Simpson or Lewinsky scandal.

Is the situation hopeless? Not at all. I see a revolution coming which can change everything! It can take the big foot of government (currently America's fastest growing industry) off our necks. It can cut our government back to that envisioned by the framers of the Constitution, where taxes are more on the order of 2% instead of 50%. And it can do the same for the people of China, North Korea, and so on.

So what's this big revolution?

It will start here in America. And, like the computer and compact disc revolutions, I hope I can be up front helping to lead the way.

With the development of the digital video disc (DVD), we have a way to provide hours of high quality video on a small (and getting smaller) disc. The revolution will start out, I suspect, with a few companies providing alternative ways for kids to learn to read and write, then arithmetic and the other stuff kids are being exposed to in public schools. Parents will get these courses at first as a way to help their children do better in school. But soon these DVD courses (or programs) will have a life of their own.

The programs will have professional actors instead of the grade school teachers we're used to. The programs will be written by top-notch writers, aided by

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NEVER SAY DIE

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state-of-the-art graphics. Have you seen *Shreck* or *Dinosaurs*? The programs will be so much fun that kids will gobble them up and be looking for more.

PBS has been showing the way with some marvelous history programs — about our wars, our presidents.

We'll be seeing ads for these DVD programs on TV. I was roundly ridiculed when I predicted back in 1975 that one day we'd see ads for computers on TV. Yeah, sure.

The programs will expand to cover all school subjects, and then on to programs on anything else youngsters will want to learn about. We'll see adult learning programs, plus programs to help us learn skills. Thousands of programs. And all available dubbed in *any* language. Including Chinese and Swahili.

Here's learning at a fraction of the cost of today's school system, and easily a hundred times better.

No government can keep down an educated and motivated citizenry for long. I just hope that our educational revolution comes along in time to bring so much prosperity to China that they're able to throw out the communist leaders.

Education, brought to Africa, will help those countries get rid of their dictators and despotic governments.

Now, being practical, I believe this revolution can be triggered by a publication, just as my publications sped up our having cell phones, personal computers, and CDs. It'll take about a half of a million dollars to get such a publication nationally distributed. Know anyone with a half mil and an interest in totally changing the world? Yes, of course I've done a business plan already.

Government

Government doesn't work. It doesn't keep our streets safe and it doesn't educate our children. Government is good at only one thing: It breaks your legs, hands you a pair of crutches, and says, "See, without us you wouldn't be able to walk." — Harry Browne.

Art Bell

In December I went to Pahrump NV to visit Art. Wow, what a ham setup he has! Pahrump is way the hell out in the desert. Flat, with mountain ranges around it. Art's hundred-foot tower made his home easy to spot from a couple of miles away. He's got satellite dishes, big and small, and plenty of emergency power.

There's a wind generator, a big bank of solar cells, and a propane-powered generator with about 600 gallons of fuel. If anything serious ever happens Art's station will be the last to run out of power. He's got hundreds of satellite channels for entertainment.

He does his Coast-to-Coast AM radio show from his ham shack, with video cameras all around the room to provide live video via the Internet during the show. Well, semi-live — he just sits there and talks.

We got on the air and made a short contact with a ZS6. He'd never heard of either of us, so it was a routine contact.

I caught Art and Ramona just before they were leaving in their RV for a trip to California. And what an RV! Ham radio? Of course! Satellite TV that automatically follows the satellites no matter how the RV turns? Sure. Built-in computer? Of course. Huge.

Thrifty Wayne

I'm *not* cheap ... I'm, er, thrifty. I love to shop in the Dollar Stores. If we had 99¢ stores in New Hampshire, I'd be checking them out, too. Then there's the Building 19 chain of el cheapo stores. I can't pass one by. I've gotten some great books there, marked down to one to three bucks. I buy a bagful. That's where I get my reading glasses for two bucks. No sales tax here in New Hampshire, either.

How can China make watches ... perfectly good digital watches ... that sell for a dollar? My Rolexes are retired. The only downside is that I do have to take the watch off when I take a shower. It isn't waterproof. But, for a buck? So what? I solved that problem easily ... I cut down on my showers ... as you may notice if you stop by to visit unannounced.

They have an even bigger bargain at 19. For five bucks you get the dollar watch, plus a Chinese imitation of the Swiss Army pocket knife, and a fold-up pair of pliers, with wire cutters, a knife, screwdriver, bottle opener, can opener, file, and saw. Folded up it's 3 x 1.5 x 0.5 inches! Just what you need in a kitchen drawer or a glove compartment. The little knife is always in my pocket and gets used dozens of times a day ... like opening cartons and prying tape off inkjet cartridges to refill them. It has a knife, scissors, and a file.

I got one of the first Sony Walkmans when they came out an eon or so ago. It's great to listen to tapes people send me promoting health products which are guaranteed to change my life, or have music with me when I'm out brisk-walking or skiing. The local Dollar Store had a Chinese AM/FM cassette player, with earphones and two small desk speakers ... are you ready? ... for $10!

I couldn't resist another Dollar Store Chinese deal ... an AM/FM radio, plus dual cassettes, with high-speed dubbing. Ready? $20! When I got this treasure home I found it had an added benefit not mentioned on the box. In some way, when I tuned the AM band, it was overlaid with shortwave stations ... roaring in. Yow! That's probably why they dumped 'em for such a low price, once a boatload of 'em arrived at Curtis up in Etibicoke, Ontario.

I'm just as cheap ... er ... thrifty ... in my travels. I keep a daily diary on my laptop when I go on trips. I've put these into two five-buck books that'll have you reading out loud to your family. One covers my trips to Russia, Ukraine, St. Pierre, London, Munich, Krakow, Prague, and Vienna. The other, my scuba diving and ham visiting trips all around the Caribbean and the Hawaiian Islands. Eleven countries in 21 days, diving all but one (Guadeloupe), where the hams kept me too busy with parties. Too expensive? How about $360 to visit all eleven islands? Have you visited Barbados, Tobago, Grenada, St. Vincent, Guadeloupe, Antigua, Montserrat, Anguilla, Nevis, St. Kitts, or St. Lucia? What's

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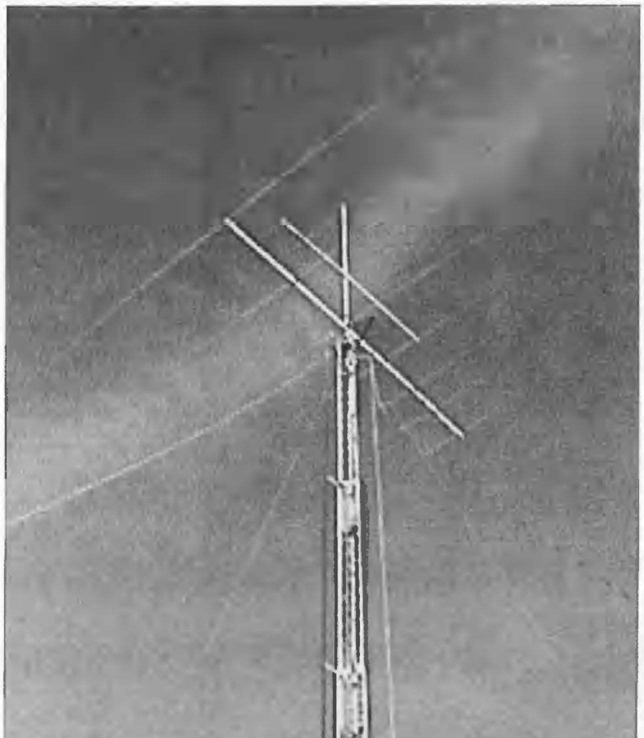
Art Bell W6OBB Gets a visitor!



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Skip City

Like July, August is set firmly in the HF "doldrums" of summer, so solid DX will be a challenge to find. Expect high signal attenuation during the day with D-layer absorption peaking at local noon. High noise levels will be the norm most nights, but a lingering E-layer may provide weak-but-steady propagation up to midnight. Don't forget that sporadic-E can appear any time, especially when solar flux has been high and the geomagnetic index low.

For those seeking unusual long-distance contacts, the best bet is on morning and evening gray-line propagation. The most efficient technique is to use a gray-line calculator (many can be found on-line) to determine when the transition occurs. By keeping skip distances in mind you can often pinpoint where your windows of opportunity will arise. By "parking" your receiver on frequency ahead of time you can be ready for those distant stations as they pop up, but remember, the window for any location will only last about twenty minutes. Good luck!

Band by Band Summary

10 and 12 meters

Signals will be weak due to daytime absorption, but some openings can still be found, especially from the southeast through southwest. Peaks will occur in the morning or late afternoon, with evenings remaining weak but open until 9 or 10 p.m. Skip should fall between 1,000 and 2,000 miles.

15 and 17 meters

DX should be slightly improved over last month with stronger signals heard early in the morning or late in the afternoon. These bands should hold up well into the evening, especially later in the month. Skip should extend out to 2,300 miles.

20 meters

Expect strong signals in the morning, late afternoon, and evening hours. Some days the band should hold up past midnight,

August 2001

SUN	MON	TUE	WED	THU	FRI	SAT
			1 F	2 F-P	3 P	4 F-P
5 F	6 F-P	7 F	8 F-P	9 F	10 F-P	11 P
12 F-P	13 F	14 F-G	15 F	16 F-P	17 F-P	18 F
19 F-G	20 F-G	21 F	22 F	23 F-G	24 G	25 G
26 F-P	27 P	28 F-P	29 F	30 F-G	31 F	

GMT	00	02	04	06	08	10	12	14	16	18	20	22
EASTERN UNITED STATES TO:												
Central America	15-20	(15) 30	20 (40)	(20-40)	x	(20)	20	(20)	(15)	(15)	15 (20)	(10) 17
South America	15 (20)	(15) 20	20 (40)	(20-40)	(20)	x	(15)	(15)	x	(10)	(10-20)	(10) 20
Western Europe	20	20	(20-40)	(40)	x	(20)	x	x	x	x	(20)	20
South Africa	x	(40)	x	(20)	x	x	x	x	(15)	(15)	x	x
Eastern Europe	20	20 (40)	(20)	x	x	x	(20)	x	x	(15)	(15)	(20)
Middle East	20	20 (40)	(20)	x	x	x	x	x	x	x	(20)	(15)
India/ Pakistan	(15-20)	(20)	x	x	(20)	x	x	x	x	x	x	x
Far East/ Japan	(15)	x	x	x	x	x	(20)	(15-20)	(15)	x	x	(15)
Southeast Asia	(15-20)	x	x	(20)	x	x	(20)	x	x	(15)	x	x
Australia	(15)	(15)	x	x	(20-30)	(20-30)	(20)	(20)	x	x	x	x
Alaska	(15-20)	(15-20)	(15-20)	20	20 (40)	(20-40)	(20)	(20)	x	x	(15)	(15-20)
Hawaii	(15-20)	(15-20)	(15-20)	20	20 (40)	(20-40)	(20)	(20)	x	x	x	(15)
Western USA	(10) 30	(10) 30	(10) 40	(15) 40	(20) 40	(20-40)	(15) 20	(10) 20	(10-20)	(10-20)	(10-20)	(10) 20
CENTRAL UNITED STATES TO:												
Central America	(10) 20	(15) 30	20 (40)	20 (40)	(20-40)	(20)	(20)	(15) 20	(15-20)	(10-20)	(10-20)	(10) 17
South America	10 (20)	(10) 20	(15) 30	(15) 30	(20-40)	(20)	(20)	(15)	(15)	(10)	(10-15)	(10-20)
Western Europe	(15) 20	20	(20-40)	(20-40)	x	(20)	(20)	x	x	x	x	(15-20)
South Africa	x	x	(40)	(20-40)	(20)	x	x	x	(10-15)	(10-20)	(20)	x
Eastern Europe	(20)	(20)	(20)	(20)	x	x	(20)	(20)	x	(15)	(15-20)	(15-20)
Middle East	(15-20)	(20)	(20)	(20)	x	x	x	x	x	x	(20)	(20)
India/ Pakistan	(15-20)	(15-20)	(20)	x	x	x	(20)	x	x	x	x	x
Far East/ Japan	x	(15)	(15)	x	x	(20-40)	(20)	20	(20)	x	x	x
Southeast Asia	(15)	(15)	(15-20)	(20)	x	x	(20)	(20)	(15-20)	(15)	(15)	x
Australia	(15)	(15)	(15)	(20)	20 (40)	(20-40)	(20-40)	20	(20)	x	(15)	x
Alaska	(10) 30	(10) 30	(10) 40	(15) 40	(20) 40	(20) 40	(20-40)	(15-40)	(10) 30	(10-20)	(10-20)	(10) 20
Hawaii	(15-20)	15 (20)	(15-20)	20	20	(20)	20	(20)	x	x	x	(15)
WESTERN UNITED STATES TO:												
Central America	(10) 17	(15) 20	(15) 20	20	(20)	(20)	(20)	(20)	(20)	(10-20)	(10-15)	(15-20)
South America	(10-20)	(10) 17	15-20	(15) 20	(20)	(20)	(20)	(15)	(15)	x	(15)	(10-15)
Western Europe	(15-20)	(20)	20	(20)	x	x	x	(20)	(15)	(15)	(20)	(15-20)
South Africa	x	x	x	(20)	(20)	x	x	(20)	(20)	(15)	x	x
Eastern Europe	(15-20)	(20)	(20)	(20)	x	x	x	(20)	x	x	x	(15-20)
Middle East	(20)	(15-20)	(15-20)	(20)	x	x	x	x	x	x	x	(20)
India/ Pakistan	x	x	(15)	x	x	x	x	(20)	x	(15)	x	x
Far East/ Japan	(15)	(15)	(20)	(20)	(20)	(20-40)	(20-40)	(20)	(20)	(15-20)	x	(15)
Southeast Asia	x	x	(15)	(15)	x	(20)	(20)	(20)	(15-20)	(15-20)	(15)	x
Australia	(10-15)	(10-15)	15	(15-20)	20	20	20	(20)	20	(20)	x	(15)
Alaska	(10) 40	(10) 40	(10) 40	(15) 40	(20) 40	(20) 40	(20-40)	20-40	(15) 40	(10) 40	(10) 40	(10) 40
Hawaii	(10-15)	(10-20)	(10-20)	(15-20)	20	20	(20-40)	20 (40)	(20-40)	x	x	(10-15)
Eastern USA	(10) 30	(10) 30	(10) 40	(15) 40	(20) 40	(20) 40	(20-40)	(15-20)	(10) 20	(10-20)	(10-20)	(10) 20

Table 1. *Band, time, country chart. Plain numerals indicate bands which should be workable on Fair to Good (F-G) and Good (G) days. Numbers in parentheses indicate bands usually workable on Good (G) days only. Dual numbers indicate that the intervening bands should also be usable. When one number appears in parentheses, that end of the range will probably be open on Good (G) days only.*

especially west or northwest of your location. Short-skip can vary between 500 and 200 miles during the day and from 1,000 to 2,300 miles at night.

30 and 40 meters

Atmospheric noise will continue to plague these bands, but some improvement should be seen late in the month. Try the gray-line technique for your best chance at very long distances. Skip can vary between 500 to 2,000 miles at night and about 750 miles during the day.

80 and 160 meters

High static will mask signals on these bands most of the time, but late August may provide some relief for this situation. Peaks will occur around midnight and in the hour or so before sunrise. Short skip will be between 1,000 and 2,000 miles.

QRX

continued from page 6

There is no drawing against "tomorrow." You must live on today's deposits. Invest it so as to get the biggest return, the utmost in health, happiness, and success! Always make the most of today.

To realize the value of ONE YEAR, ask a student who has failed his final exam.

To realize the value of ONE MONTH, ask a mother who has given birth to a premature baby.

To realize the value of ONE WEEK, ask an editor of a weekly newspaper.

To realize the value of ONE DAY, ask the daily wage laborer who has ten kids to feed.

To realize the value of ONE MINUTE, ask the student who has missed the school bus.

To realize the value of ONE SECOND, ask the person who has survived an accident.

To realize the value of ONE MILLISECOND, ask the person who won the silver medal at the Olympics.

Treasure every moment you have. Share it with someone special, because TIME never waits.

Thanks to The Purple Crystal, *a bulletin of the Independent Repeater Association, Inc., December 1997.*

Yasme Amateur Radio Foundation to Publish History

A husband-and-wife team who took ham radio to some 200 countries will be the main subjects of a book soon to be published. The Yasme Foundation has commissioned a full-length history of the foundation and a biography of its two principal luminaries, Lloyd Colvin W6KG (who died in 1993) and Iris Colvin W6QL (who died in 1998).

The assistance of radio amateurs and others around the world is sought in this effort. The foundation has retained freelance writer Jim Cain K1TN to write the book. Anyone with information to share (reminiscences, anecdotes, photos, etc.) may contact him at [yasmebook@mybizz.net].

"The foundation is extremely pleased to have Jim Cain, a writer well-known and respected among radio amateurs and a licensed ham since 1961, to research and write this important amateur radio history of Lloyd and Iris Colvin, W6KG and W6QL. "We believe that Jim is the most qualified person for the job," said Yasme Foundation president Wayne Mills.

The Yasme Foundation is a not-for-profit corporation organized to conduct scientific and educational projects related to amateur radio, including DXing and the introduction and promotion of amateur radio in underdeveloped countries.

Lloyd and Iris Colvin visited and operated from more than 200 ARRL DXCC countries, including nearly every member-country of the United Nations. Other amateur radio operations under the Yasme banner were conducted by Danny Weil VP2VB; Martti Laine OH2BH; and the late Dick McKercher WØMLY, among others. A list of Yasme operations can be found at [http://www.yasme.org].

The Yasme Foundation's officers and directors are Wayne Mills N7NG (president); Rusty Epps W6OAT; Bob Vallio W6RGG; Charles "Mac" McHenry W6BSY; G. Kip Edwards W6SZN; Martti Laine OH2BH, and Fred Laun K3ZO.

Thanks to Yasme.

Words of Wisdom?

"The wireless music box has no imaginable commercial value. Who would pay for a message sent to nobody in particular?" — David Sarnoff's associates, in response to his urgings for investment in the radio in the 1920s.

Thanks to the February 1997 issue of The Communicator, *monthly newsletter of the Central New Hampshire ARC.*

What Goes Around

Junior had just received his brand-new driver's license. The family trooped out to the driveway, and climbed into the car, where he was about to take them for a ride for the first time. Dad immediately headed for the backseat, directly behind the newly minted driver.

"I'll bet you're back there to get a change of scenery after all those months of sitting in the front passenger seat teaching me how to drive," said the beaming boy to the ol' man.

"Nope," came Dad's reply. "I'm gonna sit here and kick the back of your seat as you drive, just like you've been doing to me all these years."

Thanks to Stu Greenwood AB7BA, from Giggle Hertz in the Nov. 1998 issue of Radio Flyer.

Read All About It!

continued from page 33

in 1835. That same year he invented the relay, which contained all the technology needed for the telegraph, but Henry was not interested in pursuing this application. In fact, he readily shared his electrical knowledge with Morse, who was in dire need of it, when Morse was bringing his idea to reality in 1837. Henry also invented the first electric motor, a rocking-arm contraption which he referred to as a toy. The unit of inductance is named after Henry.

James Clerk Maxwell (English) produced the most stunning synthesis in electrical history in 1864 when he brought the results of Ampere, Faraday, Henry, and others together into a single set of equations describing literally all electromagnetic phenomena. An obscure and nonstandard unit of magnetic flux is named for him — a poor tribute to the greatest electrical theorist of the nineteenth century.

One of the predictions of Maxwell's equations was the existence of electromagnetic waves with a velocity equal to the velocity of light, which had already been measured. Heinrich Hertz, a German, actually produced the waves predicted by Maxwell (wavelength, about six meters) in 1888. The international designation for cycle-per-second, the hertz (Hz) is named for him. Marconi, in Italy, read of the early death of Hertz, and of his researches, in 1894, and went on to invent wireless telegraphy.

Émile Baudot (French) invented a 5-bit code to represent the letters of the alphabet and other characters in 1875. The unit of data transmission, the baud, is named for him. In a great miscarriage of justice, the inventor of the digital computer (Charles Babbage, 1833) goes unrecognized, with nothing named after him.

Has anyone else been left out in assigning unit names to electrical quantities? Yes, indeed! Benjamin Franklin's researches in electricity predate all others mentioned above. In 1752 he flew a kite into a thunder cloud to prove that lightning is a huge electrostatic discharge. He invented the

lightning rod, the first practical success in controlling electricity. He experimented with the lethal effects of electric shock. He invented the terms armature, battery, and condenser. He recognized that electric current was a flow of something, and postulated the positive-to-negative direction. Yet when honors were passed out by the naming of electrical units, Franklin was passed over.

On The Go

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as well as the information you need to join. Naturally there is a bit of paperwork involved, including an application and a copy of your amateur radio license. After everything is processed, you'll receive a copy of the correspondence course and your callsign. Navy MARS stations begin with "NNNØ" followed by three letters. For about six months you'll be in a training mode, working on the correspondence course and participating in net operations. During this time you'll have the designation "Tango" added to the end of your MARS callsign. This lets others know that you are going through the same training as everyone else. Other MARS operators are normally very helpful, especially to a newcomer, and this lets them know that you are learning how the service operates. Once you have met all of the training requirements, the final "T" will be dropped from your callsign and you will function as a full-fledged MARS member.

If you are looking for an opportunity to try a different aspect of the hobby and make a real contribution, you should check into opportunities with MARS. If you are a veteran and ever had the chance to send or get a message by MARS, you can pass the favor on to those in uniform today. On top of it all, you'll meet a great group of hams doing something pretty special.

QRP

continued from page 41

boxes and found about a dozen assembled Micro M controllers. They look complete, but they are not tested. I don't really recall why I have them. If you want one of the dozen or so, they're ten bucks each, and that includes shipping. I would suggest you send me an E-mail if you want one. Remember that these are not tested and may or may not work.

I also have some bare PC boards. These are $5 each. I have several dozen PC boards on hand. When these are gone, there will be no more!

Next time, I'll look at a really compact HF antenna. I'll also do a few home-brew single band antennas, too.

Homing In

continued from page 48

RDF adventures. PCC's other Saturday scholars watched in amazement as these high school kids roamed the campus, tracking down my camouflage-painted ammunition boxes with quarter-wavelength whips on top and two-meter transmitters inside.

Hats off to KF6DSA and AD6PQ for putting together a first-rate ham radio and RDF experience for NASA-PSA and Upward Bound students. The spring 2001 semester is over, but I'm sure that it won't be the end of RDF adventures for Pasadena's youth. The receivers, antennas and attenuators are ready for the next group. The hams are ready, too.

"I'm recommending to Dr. Conner that he consider budgeting a project to build some transmitters for foxhunting in 2002," Mark says. "We would also spend more class and field time getting into the technology of RDF. The returning kids from this year would gain more experience and would train the new ones in it.

"I'd like to get it to the point where PRC members are ham ambassadors for the local scout troops," KF6DSA continues. "Another ham in PRC wanted to start this, but he couldn't latch onto the funding to build 20 RDF sets. Now we have 'em!"

I learned a lot from my experiences with NASA-PSA at PCC. Perhaps my most important discovery was that there are agencies eager to provide funding to educational activities like this. Now you know it, too. Will your ham club be the next to use such sponsorship to obtain the materials for acquainting young people with Amateur Radio and RDF?

My "Homing In" Web site has links to Upward Bound and NASA-PSA sites, and tells about simple RDF equipment that students can build. Send E-mail or postal mail to me if you want to get in touch with organizers of the Pasadena sessions to get their suggestions. Get started now, and when you put on a similar program in your area, be sure to let me know about it.

The Best in Action

Final preparations are underway for the First USA ARDF Championships as this issue reaches your mailbox. Dozens of radio-orienteers will arrive in Albuquerque, New Mexico on July 31st for four days of training, competition and fellowship. Participants are expected to come from coast to coast and in between, plus Australia, China, Mongolia and Ukraine.

It's too late for registration to compete. However, it may still be possible to view the events, two meters on Thursday and 80 meters on Friday. In accordance with International Amateur Radio Union rules, each day's hunt will have five transmitters hidden throughout a very large section of forested terrain in the nearby mountains. Contact the Albuquerque Amateur Radio Club (E-mail to [abqardf@yahoogroups.com]) for more information.

Never Say Die

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stopping you? The friendly hams and the fantastic scuba diving reefs are waiting for you. What's it take to get you off the couch?

How was it possible for Sherry and me to fly first class round trip to Munich, rent an Audi and visit hams in Austria, Poland, and Czechoslovakia, stay at excellent hotels, and do the whole works for under $1,000? Talk about thrifty!

PC Uses

The first personal computer arrived in January 1975. In kit form from MITS, in Albuquerque. It was a last-minute desperate attempt by Ed Roberts to keep his company afloat. He'd bet heavily on making the first four-banger hand calculators. He was charging $129 for 'em and doing a pretty good business. He was even advertising 'em in *73* magazine.

Then, suddenly, came Casio with the same thing for $10, and pffft went MITS's bread and butter.

Ed had been a computer hobbyist, so he put the Altair 8800 out in kit form for computer hobbyists. One thing Ed didn't mention in his ads was that not all of the boards had ever been made to work. He figured that hobbyists would find this out quickly enough, and they would come up with fixes that he could then incorporate into later boards. Which is just what happened.

There was no software for the 8800. Nothing. You built it, flipped the switches on the front panel, and watched the lights dance.

Naturally, being a gadget nut, I bought one and put it together. Hmm, no input

Continued on page 64

Wise Up!

Here are some of my books which can change your life (if you'll let 'em). If the idea of being healthy, wealthy and wise interests you, start reading. Yes, you can be all that, but only when you know the secrets which I've spent a lifetime uncovering.

......*Wayne*

The Secret Guide to Health: Yes, there really is a secret to regaining your health and adding 30 to 60 years of healthy living to your life. The answer is simple, but it means making some serious lifestyle changes. Will you be skiing the slopes of Aspen with me when you're 90 or doddering around a nursing home? Or pushing up daisies? No, I'm not selling any health products, but I can help you cure yourself of cancer, heart trouble, or any other illness. Get this new, 2001 expanded edition (156p). $10 (#05)

The Secret Guide to Wealth: Just as with health, you'll find that you have been brainwashed by "the system" into a pattern of life that will keep you from ever making much money and having the freedom to travel and do what you want. I explain how anyone can get a dream job with no college, no résumé, and even without any experience. I explain how you can get someone to happily pay you to learn what you need to know to start your own business. $5 (#03)

The Secret Guide to Wisdom: This is a review of around a hundred books that will boggle your mind and help you change your life. No, I don't sell these books. They're on a wide range of subjects and will help to make you a very interesting person. Wait'll you see some of the gems you've missed reading. You'll have plenty of fascinating stuff to talk about on the air. $5 (#02)

The Bioelectrifier Handbook: This explains how to build or buy ($155) a little electrical gadget that can help clean your blood of any virus, microbe, parasite, fungus or yeast. The process was discovered by scientists at the Albert Einstein College of Medicine, quickly patented, and hushed up. It's curing AIDS, hepatitis C, and a bunch of other serious illnesses. It's working miracles! The circuit can be built for under $20 from the instructions in the book. $10 (#01)

My WWII Submarine Adventures: Yes, I spent from 1943-1945 on a submarine, right in the middle of the war with Japan. We almost got sunk several times, and twice I was in the right place at the right time to save the boat. What's it really like to be depth charged? And what's the daily life aboard a submarine like? How about the Amelia Earhart inside story? If you're near Mobile, please visit the Drum. $5 (#10)

Wayne's Caribbean Adventures: My super budget travel stories – where I visit the hams and scuba dive most of the islands of the Caribbean. You'll love the special Liat fare which let me visit 11 countries in 21 days, diving all but one of the islands, Guadeloupe, where the hams kept me too busy with parties. $5 (#12)

Cold Fusion Overview: This is both a brief history of cold fusion, which I predict will be one of the largest industries in the world in the 21st century, plus a simple explanation of how and why it works. This new field is going to generate a whole new bunch of billionaires, just as the personal computer industry did. $5 (#20)

Cold Fusion Journal: They laughed when I predicted the PC industry growth in 1975. PCs are now the third largest industry in the world. The cold fusion ground floor is still wide open, but then that might mean giving up watching ball games. Sample: $10 (#22).

Julian Schwinger: A Nobel laureate's talk about cold fusion—confirming its validity. $2 (#24)

Improving State Government: Here are 24 ways that state governments can cut expenses enormously, while providing far better service. I explain how any government bureau or department can be gotten to cut it's expenses by at least 50% in three years and do it cooperatively and enthusiastically. I explain how, by applying a new technology, the state can make it possible to provide all needed services without having to levy *any* taxes at all! Read the book, run for your legislature, and let's get busy making this country work like its founders wanted it to. Don't leave this for "someone else" to do. $5 (#30)

Mankind's Extinction Predictions: If any one of the experts who have written books predicting a soon-to-come catastrophe which will virtually wipe most of us out are right, we're in trouble. In this book I explain about the various disaster scenarios, like Nostradamus, who says the poles will soon shift (as they have several times in the past), wiping out 97% of mankind. Okay, so he's made a long string of past lucky guesses. The worst part of these predictions is the accuracy record of some of the experts. Will it be a pole shift, a new ice age, a massive solar flare, a comet or asteroid, a bioterrorist attack? I'm getting ready, how about you? $5 (#31)

Moondoggle: After reading René's book, *NASA Mooned America*, I read everything I could find on our Moon landings. I watched the NASA videos, looked carefully at the photos, read the astronaut's biographies, and talked with some readers who worked for NASA. This book cites 45 good reasons I believe the whole Apollo program had to have been faked. $5 (#32)

Classical Music Guide: A list of 100 CDs which will provide you with an outstanding collection of the finest classical music ever written. This is what you need to help you reduce stress. Classical music also raises youngster's IQs, helps plants grow faster, and will make you healthier. Just wait'll you hear some of Gotschalk's fabulous music! $5 (#33)

The Radar Coverup: Is police radar dangerous? Ross Adey K6UI, a world authority, confirms the dangers of radio and magnetic fields, including our HTs and cell phones. $3 (#34)

Three Gatto Talks: A prize-winning teacher explains what's wrong with American schools and why our kids are not being educated. Why are Swedish youngsters, who start school at 7 years of age, leaving our kids in the dust? Our kids are intentionally being dumbed down by our school system — the least effective and most expensive in the world. $5 (#35)

Aspartame: a.k.a. NutraSweet, the stuff in diet drinks, etc., can cause all kinds of serious health problems. Multiple sclerosis, for one. Read all about it, two pamphlets for a buck. (#38)

$1 Million Sales Video: The secret of how you can generate an extra million dollars in sales just by using PR. This will be one of the best investments you or your business will ever make. $40 (#52)

Reprints of My Editorials from *73*. Very few things in this world are as we've been taught, and as they appear. I blow the whistle on the scams around us, such as the health care, our school system, our money, the drug war, a college education, sugar, the food giants, our unhealthy food, fluorides, EMFs, NutraSweet, etc.

1996 Editorials: 120 pages, 100 choice editorials. $10 (#72)

1997 Editorials: 148 fun-packed pages. 216 editorials. $10 (#74)

1998 Editorials: 168 pages that'll give you lots of controversial things to talk about on the air. $10 (#75)

1999 Editorials: 132 pages of ideas, book reviews, health, education, and anything else I think you ought to know about. $10 (#76)

2000 Editorials: 76 pages (thinner magazine as a result of our slowly dying hobby). $5 (#77)

Silver Wire: With two 5-in. pieces of heavy pure silver wire + three 9V batteries you can make a thousand dollars worth of silver colloid. What do you do with it? It does what the antibiotics do, but germs can't adapt to it. Use it to get rid of germs on food, for skin fungus, warts, and even to drink. Read some books on the uses of silver colloid, it's like magic. $15 (#80)

Colloid Reprint. April 97 article on a silver colloid maker, history, and how to use the stuff. $5 (#98).

Colloid Kit. Three 9V battery clips, 2 aligator clips & instructions. $5 (#99).

Wayne's Bell Saver Kit. The cable and instructions enabling you to inexpensively tape Art Bell W6OBB's nightly 5-hr radio talk show. $5 (#83)

NH Reform Party Keynote Speech. It wow'd 'em when I laid out plans for NH in 2020, with much better, yet lower cost schools, zero state taxes, far better health care, a more responsive state government, etc. $1 (#85)

Stuff I didn't write, but you need:

NASA Mooned America: René makes an air-tight case that NASA faked the Moon landings. This book will convince even you. $30 (#90)

Last Skeptic of Science: This is René's book where he debunks a bunch of accepted scientific beliefs – such as the ice ages, the Earth being a magnet, the Moon causing the tides, and etc. $30 (#91)

Dark Moon: 568 pages of carefully researched proof that the Apollo Moon landings were a hoax—a capping blow for René's skeptics. $35 (#92)

Dark Moon Video: 222-minute exposé nailing NASA with their own photos. If you've watched the NASA films of the astronauts walking on the Moon you wondered at their weird gait. Wait 'll you see it speeded up. It looks exactly like they're running on Earth! They catch NASA in dozens of giveaways that the photos and films had to have been faked. $46 (#93)

Travel Diaries: You can travel amazingly inexpensively – once you know the ropes. Enjoy Sherry and my budget visits to Europe, Russia, and a bunch of other interesting places. How about a first class flight to Munich, a rented Audi, driving to visit Vienna, Krakow in Poland (and the famous salt mines), Prague, back to Munich, and the first class flight home for two, all for under $1,000. Yes, when you know how you can travel inexpensively, and still stay in first class hotels. $5 (#11)

73 Writer's Guide: It's easy, fun, can pad your résumé, and impress the hell out of your friends. $0 (#78)

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The *73* Flea Market, Barter 'n' Buy, costs you peanuts (almost)— comes to 35 cents a word for individual (noncommerciall) ads and $1.00 a word for commercial ads. Don't plan on telling a long story. Use abbreviations, cram it in. But be honest. There are plenty of hams who love to fix things, so if it doesn't work, say so.
Make your list, count the words, including your call, address and phone number. Include a check or your credit card number and expiration. If you're placing a commercial ad, include an additional phone number, separate from your ad.
This is a monthly magazine, not a daily newspaper, so figure a couple months before the action starts; then be prepared. If you get too many calls, you priced it low. If you don't get many calls, too high.
So get busy. Blow the dust off, check everything out, make sure it still works right and maybe you can help make a ham newcomer or retired old timer happy with that rig you're not using now. Or you might get busy on your computer and put together a list of small gear/parts to send to those interested?

Send your ads and payment to: *73 Magazine*, Barter 'n' Buy, 70 Hancock Rd., Peterborough NH 03458 and get set for the phone calls. The deadline for the October 2001 classified ad section is August 10, 2001.

NEVER SAY DIE

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device. So I turned to Southwest Tech, which had just released a keyboard, and built one of those. When it didn't talk to the Altair I fussed with both companies, but neither had an answer. Then I got a call from a 16-year old hobbyist and he had the answer for me.

In January 1976 MITS held an Altair user conference. By this time some questions had been raised about what we hobbyists might be able to do with these light-flickering contraptions. The only suggestion Ed made was that well, they might be used to control a grass watering system. It's 25 years later and still I haven't seen that system in my gardening catalogs.

Olson, DEC's president, when asked about home computers, ridiculed the question. Why on earth would anyone ever want a computer at home? His brilliant foresight helped kill the biggest minicomputer company in the world. The same mindset also killed Wang, Data General, Prime, and all the other minicomputer companies.

THE NEW! 73 Amateur Radio Today®

SEPTEMBER 2001
ISSUE #490
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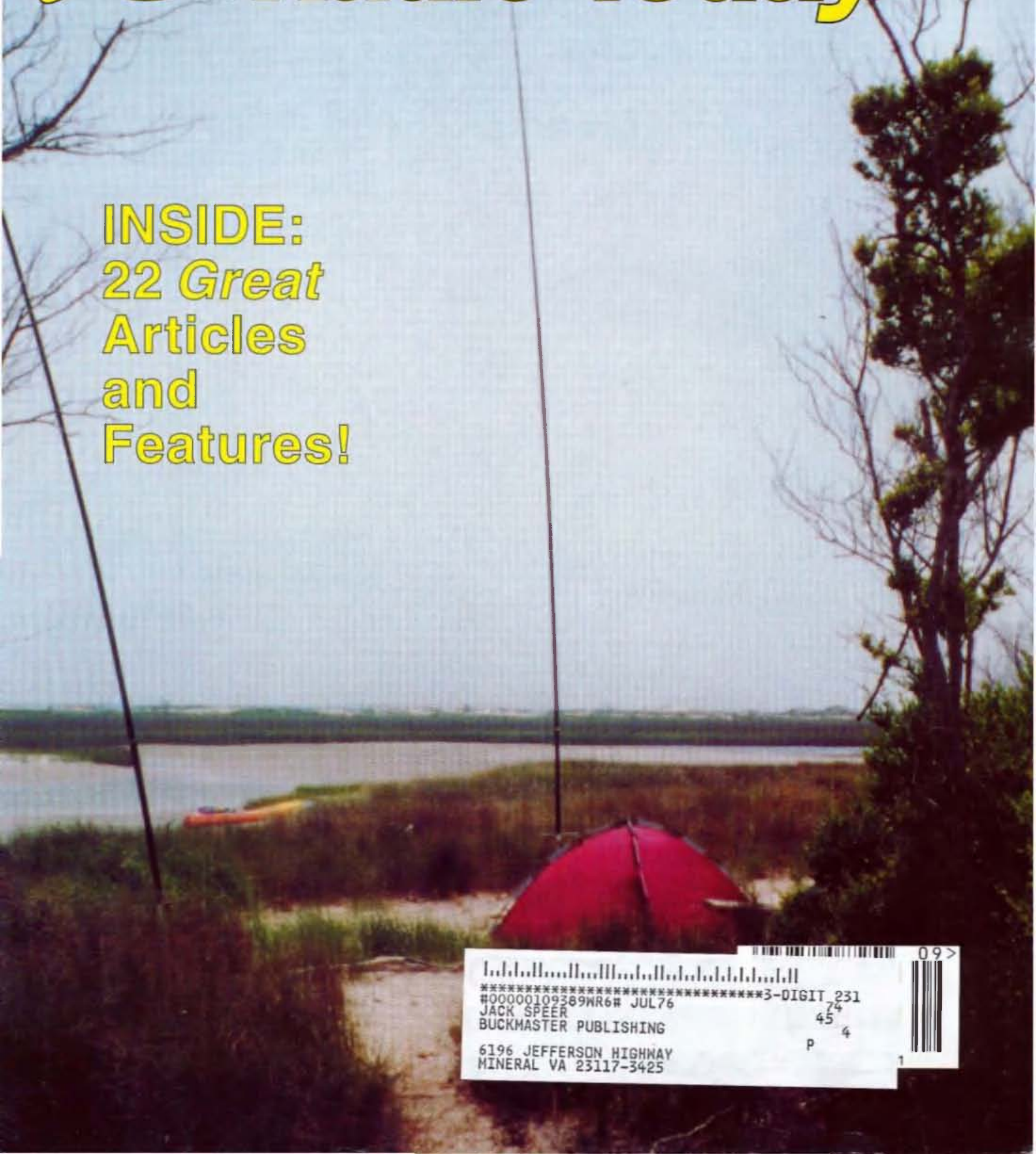

THE TEAM

SEPTEMBER 2001
ISSUE #490

THE NEW!

73 Amateur Radio Today

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DEPARTMENTS

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QRX . . .

Anagrams

An anagram, as we all know, is a word or phrase where letters are rearranged to form another word or phrase:

Dormitory = Dirty Room
Evangelist = Evil's Agent
Desperation = A Rope Ends It
The Morse Code = Here Comes Dots
Slot Machines = Cash Lost in 'em
Animosity = Is No Amity

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Manuscripts: Contributions for possible publication are most welcome. We'll do the best we can to return anything you request, but we assume no responsibility for loss or damage. Payment for submitted articles will be made after publication. Please submit both a disk and a hard copy of your article [IBM (ok) or Mac (preferred) formats], carefully checked drawings and schematics, and the clearest, best focused and lighted photos you can manage. "How to write for 73" guidelines are available on request. US citizens, please include your Social Security number with submitted manuscripts so we can submit it to you know who.

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Wise Up & Beat the Odds

NEVER SAY DIE

Wayne Green W2NSD/1
w2nsd@aol.com
www.waynegreen.com

Ham Club Talks

The Santa Barbara club broke the ice when Untied Airlines was unable to get me further than Chicago on my way to give a talk to the club. What a frustrating day that was! Finally, around two in the morning, I managed to get back home. The simple solution, which I should have thought of years ago, was to give my talk via the telephone, just as I do my talk radio interviews. They put an amplifier on their phone and it worked like a charm.

Since then I've done similar talks with clubs in Sheboygan and Nashville. How about your club? I'm available for an hour talk without the club having to fly me there and put me up for the night. Give me a call at (603) 588-0107 or E-mail me at [w2nsd@aol.com] and we'll set up a date.

I've been hoping that club program chairmen or presidents would take the initiative to set up similar phone talks with ham industry luminaries. It would sure make meetings more interesting and help build attendance.

Another Birthday

On Sunday morning, September 3rd, 1922 at 6 a.m., Dr. Giles assisted Mrs. Cleo Green in the birth of Wayne Sanger Green II in the Littleton (NH) hospital. His dad was in flight training in the Army Air Force at Kelly Field, San Antonio, Texas, and thus unable to attend my coming out ceremony.

Born in the age of the Model T, silent movies and vaudeville, I grew up around planes, the Victrola, then talkies and radio programs such as Jack Armstrong, The All-American Boy, Little Orphan Annie, and Buck Rogers In The 25th Century—all 15-minute after school radio programs.

Then, at 14, the amateur radio bug bit, causing a life-long infection I've never been able to shake.

Next year I'll be 80, and if I follow my own health advice, I'll be as healthy as most men of 40.

It's been an interesting life, going from the Model T to a Honda van with a global positioning map built in, a telephone with a ringer crank on the wall to today's E-mail and Internet, and a Waco biplane to the Concorde (yep, I flew to London and back on it). I've also watched inflation take 2¢ letter postage to 34¢ (and going up again soon). Radio has gone from the NBC red and blue, CBS and Mutual networks to 200 channels of satellite delivered television drivel.

Doom Update

It's one thing to see some crazy walking around with an The End Is Near poster, and another to read prophecies by guys whose past predictions have turned out to be on target...all telling us the same thing: The End Is Near! So how much is there to all this? Is there enough for you to worry about the safety of your family?

I've just finished updating my *Human Extinction Prophecies* book (#31 – $5), so the material is fresh in my mind. I've also just finished writing a booklet which explains how and why dowsing works, citing the scientific research supporting every step in my explanation. As far as I know, and I know pretty far, no one has figured this out before. This is *Dowsing* (#84 – $2).

Yes, dowsing really does work. Yes, there's solid scientific data supporting it. A good dowser can find anything, or anybody anywhere. And yes, prophecy is also on proven scientific ground—once you put the pieces of the puzzle together.

Most of the scientific data has been cited in books I've reviewed in my editorial essays, and are also reviewed in my *Secret Guide to Wisdom* (#02 – $5).

By the time you've read Chris Bird's *Secret Life of Plants, Secrets of the Soil*, and his *The Divining Hand*, you'll begin to see the parts of the puzzle coming together. Then read Stone's *The Secret Life of Your Cells;* Boone's *Kinship of All Life;* and Sheldrake's book on morphic resonance, *The Presence of the Past*.

Well, just as people who've read my *Secret Guide to Health* (#05 – $10) now understand that the *only* reason they get any sickness is because they are putting poisons into their body which are impairing their immune system and are unable through force of habit to stop poisoning themselves, even though the alternative is a slow, painful death—coming to grips with the possibility of the predicted coming earth changes to protect one's self and family will also mean major lifestyle changes. The option is to die, along with almost everyone else.

Are you willing to bet your family's life that Nostradamus, Edgar Cayce, Albert Einstein, Charles Hapgood, Ed Dames, Gordon Michael Scallion, the ancient Incas and Maya, are *all* wrong? Oh yes, add Chet Snow and David Jacobs too.

Their unanimity of prophecy has to do with a soon-to-come and very sudden pole shift. Paleontologists tell us that this has been happening about every 14,500 years. Guess what! The last pole shift was 14,500 years ago. We're talking 200 mph winds, mile-high waves wiping out every shoreline city in the world, and re-arranging the continents as the tectonic plates are suddenly shifted. Earthquakes, volcanoes, the works.

Nostradamus and Edgar Cayce both predicted that about 3% of humanity will survive. Chet Snow's research (*Mass Dreams of the Future*) agrees with their estimate.

If you're willing to bet your family's life that these guys are all wrong, then you don't need to worry about it and turn to the newspaper sport pages. It's best you don't read my updated book. However, if you want my advice on how your family can survive the next few years, read my book.

One key element will be your ability to get on the air

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Mother-in-law = Woman Hitler
Snooze alarms = Alas! No more Z's
Alec Guinness = Genuine Class
Semolina = Is No Meal
A Decimal Point = I'm a Dot in Place
The Earthquakes = That Queer Shake
Eleven Plus Two = Twelve Plus One

From the Sept. 1998 issue of Feedback, *the newsletter of the Johnson County RAC, Bill Eperson WBØCEF, Editor.*

UK Cell Phone Safety Campaign

The British government launched a high-priced package of safety precautions for cellular telephone users. The measures include $10 million for more research and disclosure of the radiation levels emitted by every phone model, and an audit of radio wave emissions from base stations.

Britain is the first country to embark on such a broad precautionary response to health concerns. Leaflets will summarize the safety research to date. They will note that experts have concluded that although no evidence exists that using a cell phone causes brain tumors or other ill effects, a health risk cannot be ruled out, particularly for children. For this reason the leaflets will advise that young children be discouraged from using the handsets of cellular phones at all times.

Leaflets and other materials will be distributed through phone retailers, doctors' offices, libraries, book, music and electronics retailers, post offices and supermarkets, according to UK Health Department officials. (Published news reports)

Thanks to Amateur Radio Newsline™, *Bill Pasternak WA6ITF, editor.*

Donations Wanted

The Pueblo Historical Aircraft Society (PHAS), Manager/Operator of the Pueblo (Colorado) Weisbrod Aircraft Museum, is seeking donations of airborne military radios and communications equipment from WWI, WWII, the Korean War, the Vietnam War, Desert Shield/Desert Storm, and the Cold War era.

The society is seeking these donations to compliment its display of 23 WWII and post-WWII aircraft in its new 30,000 sq. ft. hangar at the Pueblo Memorial Airport (approx. 6 miles east of Pueblo CO, on Highway 50 East).

The Pueblo Historical Aircraft Society is a non-profit organization, devoted to preserving and restoring the 23 vintage military aircraft in the museum. The Society's membership consists of military veterans and non-veterans.

All items donated to PHAS are income tax deductible and become the permanent property of PHAS. Items donated will be used to upgrade older displays and create new displays.

For more details or further information, contact Russ McGee (719) 542-2039, E-mail [wbØgsu@juno.com]; or Bill Pearce (719) 544-0691, E-mail [wØmwo@yahoo.com].

The Museum can be contacted at Pueblo CO, (719) 948-9219; fax (719) 948-2437; or by E-mail at [pwam@iex.net]. *Thanks to William G. Pearce, USNR (ret) WØMWO, Public Relations Director,Pueblo Weisbrod Aircraft Museum.*

Colorado Students Interview Astronaut via Ham Radio

Eight students from several schools in the Boulder CO area used ham radio to ask US astronaut Jim Voss about his experiences and activities aboard the International Space Station. The June 21 contact was arranged through the Amateur Radio on the International Space Station (ARISS) program.

Participants ranged from elementary school age through college, including one questioner who attends the University of Colorado in Boulder, Voss' alma mater. The students gathered at the home station of Bill McCaa KØRZ, in Boulder for the linkup, which lasted just over 10 minutes.

Students' curiosity ran the gamut from scientific to spiritual. One high schooler asked about how the lack of gravity affected Voss' sensation of balance.

"Actually, the fluids of your inner ear do change a little bit, but after a day or so, you're used to it — your eyes take over and you don't really feel like you're off balance or anything like that," Voss replied. Voss said the body adapts very quickly to space, "and you feel like you're right at home, whether you're upside down or right side up."

Another youngster asked Voss if being aboard the International Space Station made him "feel any closer to any heavenly body." Voss pointed out that the ISS was only a couple of hundred miles or so above Earth and that the view of the heavens wasn't that much different than from the ground. "I just feel further away from Earth," he said.

Voss told the students that he and his crewmates still can see the stars and planets, but they don't twinkle as they do on Earth because of the lack of atmosphere. More spectacular, he said, is the view of Earth from the ISS. "It is truly beautiful!" Voss exclaimed. Seeing Earth from space for the first time was "a very emotional experience," he said. He said the crew has been working to get the Canadian-built manipulator arm working properly and would be involved in the installation of a module that will serve as a launch platform for space walks.

Voss used the NA1SS call sign for the contact. Each student got to ask two questions. Questioners included at least two hams, 17-year-old Brian Bowman KCØFSO, and 12-year-old Emily Arthur KCØGIA.

Voss said he hoped to make it back to Boulder for an in-person visit after he returns to Earth.

Thanks to Bandbits, *the newsletter of the Peoria Area ARC, which took this from the* ARRL Letter, *Vol. 20, No. 25.*

The Greatest Generation

Tom Brokaw wrote the book entitled, *"The Greatest Generation."* If you haven't read it yet you should. This is my salute to those Americans who gave unselfishly to our country. It goes without saying that some gave the ultimate sacrifice.

A few issues back, — in *The Communicator* — I believe it was Lew Woodaman W1LEW, who wrote an article about the fantastic story of the *USS LST 325* and its return to the United States from Athens, Greece. I don't remember if Lew included the Web site or not, but I'm suggesting that you look at the site if you can, and read this remarkable story. The site includes the daily log from beginning to end of the journey. It is quite remarkable. Two men died during this ordeal, one before the end of the journey and one shortly after its return.

Bill Hart died after returning to US soil. (He made it to the airport.) Jack Carter died soon after returning with the ship. Jack was the Executive Officer of the *USS LST 325*, during the war and was a ham, KC6WYX. He used his ham experience by setting up a rig on board and used the call sign WW2LST.

These men (I counted 21 in the picture) are what the United States stands for. They are indeed the "Greatest Generation" and it's sad to know we are losing so many without hearing their stories.

One only has to read the daily obituaries to see what I mean. What a shame it is that we often don't know what this generation of men and women gave to us.

I would like to offer my time to anyone who would like to tell their story or knows of someone whose story should be told.

Also, I would like to ask everyone who reads this, to answer the following question: When was the last time you saluted the flag at a parade? I mean taking the time to remove your hat or placing your hand over your heart whenever a flag passes in a parade.

I believe it was a 4th of July parade. I had become lazy like many other people, and didn't bother to salute at parades. This four-year-old little girl asked me why I wasn't saluting like some of the others. I didn't have an answer. From that day on, I have saluted without fail. I now have grandchildren and hope someday to teach them to salute ... without fail. Just like what THEY did ... without fail.

Try it and see if it doesn't bring back that pride we all learned either in the Boy/Girl Scouts or maybe in school. It's the least we can do for those that showed the most they can do.

That Web site is [www.palosverdes.com/1st887/1st325.html].

(I put it all in and I know it's long, but you may need it all to make it work?)

Happy saluting all!

Thanks to Jack Severance KB1GQP, via the July 2001 issue of The Communicator, *monthly newsletter of the Central New Hampshire ARC.*

Emergency Service Honored by Newspaper

The Central Ohio Amateur Radio Emergency Service has won the Community Service Award from *The Columbus Dispatch,* Ohio's second-largest daily newspaper. The award — the newspaper's top public service recognition — includes a plaque and $500. The local ARES group was honored for its participation in more than 60 events annually in Franklin County. Accepting the award was COARES President Bill Carpenter AA8EY, who's also Franklin County Emergency Coordinator. "When they came to the public service groups, I was more than surprised we had won," said Carpenter, "but the honor goes to the 300 ham radio members who make this award and recognition an actuality for COARES." Carpenter says his team logged more than 6,000 hours of events work last year, mostly public service events. "We help area charities raise more than $1,000,000 annually," he said.

TNX NOARS LOG, *newsletter of the Northern Ohio Amateur Radio Society, May, 2001.*

ARES Responds to Jacksonville Fire & Rescue Communications Outage

May 13th was a routine Sunday for the Jacksonville Fire & Rescue Division (JFRD), until a pipe burst near the Central Dispatch Center downtown. Escaping water flooded critical equipment used to handle JFRD radio communications and to process incoming priority calls to JFRD being relayed from the main 911 call center at the Jacksonville Sheriff's Office (JSO).

The Jacksonville Sheriff's Office is located about eight blocks from the JFRD Central Dispatch Center. All 911 calls from those seeking emergency assistance are screened by JSO operators. Calls requiring deployment of JFRD resources then are relayed to the JFRD dispatch center. This JFRD/JSO relay link and the entire JFRD radio system went out of service around 6 p.m. Sunday.

Technicians from the City of Jacksonville Communications Division responded quickly to restore limited communications capability to JFRD dispatchers so that fire engines and fire stations could be linked. Most units countrywide were shifted to a single UHF repeater normally used for medical messages.

But the link between JSO and JFRD was expected to be out of service for several additional hours until repairs were completed. While a citizen's ability to communicate with the main 911 call center never was interrupted, the outage of the JSO/JFRD link could have caused delays in getting fire personnel and equipment underway.

At 8 p.m., JFRD officials contacted the Duval County Amateur Radio Emergency Service through Emergency Coordinator Miller Norton N4RYX. Ten hams were requested to report to the JFRD dispatch center. Miller sent members of the Amateur Radio Quick Response Team (QRT). Most arrived for duty within 30 minutes.

A direct amateur radio link was established between JSO and JFRD. Repeaters used during the response were the W4IZ 146.7/444.4 MHz system and the RANGE 146.76 MHz repeater. With an amateur radio operator serving as control operator on each end, JSO and JFRD dispatchers used the 146.76 MHz repeater to pass messages concerning 911 calls. When the main 911 call center at JSO received a request for emergency assistance involving JFRD, the request was relayed via amateur radio for almost 3 hours.

By 1:30 a.m. Monday, the JFRD/JSO link had been restored and the hams were able to leave. N4RYX reports that 21 hams responded or were involved in the effort. Those participating included General Dailey KD4VVZ, Travis Maclay N4TJM, Al Elmore W4FHP, Bill Sander KA4OBP, Don Ferris W4JSO, Steve Barber WA4B, Stephanie Barrett KF4FDN, Sandy Ingle KG4CQK, Robert Selph W4RCS, Ben Meyer KB3AMT, Lewis Jolly W4LTJ, Menard Norton KE4IOR, Robert Fife W4JFD, Jay Humphrey KF4RGU, and John Reynolds W4IJJ.

Thanks to the North Florida Amateur Radio Society's Balanced Modulator, *July-August 2001.*

Morse Code Test Changes

The National Conference of Volunteer Examiner Coordinators wants to remind you that a new set of Morse code testing standards went into effect July 1st.

The new exams use a system called the Farnsworth character spacing. This means that exams will be at 5-wpm but the spacing of the dits and dahs will be in the 13-wpm range.

The way applicants answer test questions has also changed.

For many years a multiple choice system had been utilized, but on July 1st a fill-in-the-blank arrangement took its place. This means that guessing at an answer will less likely be accurate.

The decision by the NCVEC to change Morse testing procedures came as a result of the December 1999 decision to restructure the United States Amateur Radio Service. At that time the government dropped both the 13- and 20-wpm Morse proficiency exams and ordered that a 5-wpm test be the only CW requirement for licensing in the U.S. and its possessions. (NCVEC)

Thanks to the National Conference of Volunteer Examiner Coordinators, via Newsline, *Bill Pasternak WA6ITF, editor.*

Dedicated to my Father

Back in 1954
I was puzzled about what I'd have in store
For while other girls mixed a cake at the table
I sat there working with wires and cable
While the kids outside played with dolls and toy pistols
We spent our Sunday with tubes and crystals
The soldering iron burned so much!
I was too young to know not to touch
But I'll never forget that day, the way
My Elmer kissed the pain away
He taught me the code and what's a diode
And hoped I'd reap the benefits of what he sowed
My brothers explained a volt and transistor
To their curious but resistant little sister
We'd take the train to Cortland Street
'Cause that's where all the hams would meet
And even though I'd whine and mope
I learned to use an oscilloscope!
For those who have a similar story
And hold the hobby in their glory
Look at your rig, antenna and bug

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LETTERS

From the Ham Shack

Norm VK5GI. Hi. Wayne!

Phew! OK. second one first. Include in the mag things for (don't hit me!) CBers. shortwave listeners. even for pirate radio operators (no I don't condone it. but it will improve the circulation figures!). and articles on radio and electronics Web pages. I think that the U.S. has a form of broadcasting license for low-power FM stations. so how about an article on putting our expertise to work and setting up small FM stations for isolated areas. Just a thought. Bring in the CBers and those who use radios for 4WDing. You won't lose ham readers. but you will sure gain other readers.

One of the best things I ever bought was an old FRG-7 at a swap-meet. for 50 bucks five years ago — widened my horizons no end. QRP is enjoying a renaissance — get Dave Ingram or Ade Weisse or George Dobbs or Peter Parker or Drew Diamond (see Web pages for these guys!) on-side and show the kids how to make receivers for almost no cost but a lotta fun: and us licensed hams how to make one-transistor transceivers and linear amps from one power transistor. I'd really. REALLY like to know how to make a 10-gig transceiver from the motion detectors (I have two — I only need someone to show me how!). If I had the money. I'd send a subscription of the mag to the science club at the local high school. Oh. Wayne — I could go on all night ...

Number two: How to get folks off their butts to start living a healthy life style. Here we are going to be shoveling it uphill I fear. As for me. my wife and I did the drastic and at nearly 60 years young moved to an acre of paradise out in the donga where I can grow my own veggies and raise my chooks as well as run my desktop publishing business. I do work for the local area which is rural. wine and olive growing. Truly I have NEVER in my life felt better. and bear in mind that I was born in a bomb shelter during one of the frequent visits by the Luftwaffe over Liverpool! Your editorials. Wayne. are really inspirational and mean a lot to me. Keep on keeping on!! God bless!

Hal Williams N6TZ. I agree with Roger G3LDI. but the facts are that there will never be a return to the "good ol' days." It is sad. and I must say that my earlier days of ham radio were very much more formal. mysterious. and romantic. Tuning up and down between 14.100 and 14.200 in the "foreign" portion of the band yielded many interesting. intelligent conversations from great countries. Today. a quick exchange of QSL info and S-9+ reports is about it. Maybe it was a characteristic of simpler times. for it appears to me that we do not feel the same warmth and reward in life that we enjoyed 50 years and more ago. Today. the youth does not seem to find lasting feelings and relationships in leisure interests or romantic relationships. Most of these areas seem to be caught up in an attitude of a "Let's do this one and move on" approach. I almost wonder if the whole world has developed symptoms of Attention Deficit Disorder. Maybe I am the one "out to lunch." but in conversations with a few of the people who will take the time to discuss this. I find that I am not alone.

One of the reasons I got so excited about RTTY was that suddenly I was in contact with hams who were interested in discussing ideas instead of a recitation of their rig and antenna. 73. Hal. I've been on the air for over 60 years and. outside of those RTTY contacts. I've had dozens of very interesting QSOs. — out of tens of thousands. — Wayne.

Mike Kuehl, Rhinelander WI. I enjoy your mag!

Yours truly is in the process of getting a re-tread in that I had a ticket in the 60s and let it expire. Stupid move. A thousand lashes with a wet egg noodle please. So here I am playing catch-up on 30-plus years of progress. and I hate what has happened to the art as much as I hate hearing loud rap music blaring from the open windows of four-wheeled boom boxes.

The homoginized/pasturized version of today's typical ham is a far cry from the past as I see it. Get yourself a compact 100-watt transceiver and you're on the air with a bundle of solid-state cum state-of-the-art "stuff." Sure. you need a license to fire it up into something other than a dummy load. but then what? Unless you're some kind of computer geek who doesn't care if he voids the warrantee by tinkering with the guts. that's it. What you see is what you get. and you're stuck with it! Oh. for the good old boat-anchor days when between the transmitter and receiver. a station would weigh in at 200 pounds or more!

OK. I admit it. I'm a closet tube-freak. and far more often than *CQ* or *QST*. *73* actually has articles on building tube gear. Cheers. and give me more! Take for example Charles Solomon's Junk Box 10-meter linear as shown in the August 2000 issue. using a pair of my favorite jugs. 807s. I can picture firing that pup up at 29.05 with a 2-state 6L6 CW exciter and modifying it with an AM modulator. Because I'm also a recording engineer / 40-year radio announcer vet. and have my own studio. I'll lash up a few processors in the audio chain and let fly. Bet my sound beats yours. and it will be a lot better than any single-sidewinder transceiver on the market watt for watt!

I'd like to hear from any old-timers out there. espcially those who are into AM (E-mail [mike_kuehl_sr@yahoo.com]). And if you have any transmitter diagrams from the mid 50s to mid 60s from any source. particularly in the under 350 watt class. I'd love to get some copies. Ditto any parts. especially coils and transformers. including mod. power and interstage. I'd give them a loving home.

Once I get that ticket back. it will be goodbye to the new-fangled. solid-state digital crap and go back to my roots. By the way. nobody better have the call sign K9ZSL! Listen for me in the future. I WILL QSL. Then you can ask me how I got an AM station to sound so good.

Len Fazio WA2IHI. I gave the first set of silver wires I got from you to a friend who was always catching every bug going around. Not any more! When I first got the silver wires I cured a simple ear infection. I'd had the same infection with my other ear a few weeks earlier. The doctor prescribed antibiotics ($60!). and it took a week to cure. Using silver colloid ear drops and drinking a few glasses of home-made silver colloid cured the second ear infection in three days! No wonder the FDA finally banned it. even for veterinary use!

This stuff seems to be the DUZ of the medical world — an antibiotic that microbes can't adapt to. and it costs almost nothing to use. — Wayne.

Hugh Wells W6WTU
1411 18th St.
Manhattan Beach CA 90266-4025

The Cheapest Supplies Ever

Why not put a surplus computer PS to work in your shack?

Reader Bill Brown W4OUK requested an article about computer power supplies for ham use. He is currently using a computer supply to operate his equipment, and feels that others may benefit from the suggestion.

He also commented about the increasing availability of power supplies as computers are being scrapped out. Being ingenious people, hams will most likely find applications for computer power supplies, not to mention maybe even use one as an automobile battery charger.

Thanks for the idea, Bill — let's share a little know-how.

Hams have been building and using power supplies since the beginning of time, or so it seems. All have been of the heavy iron linear type providing the well-filtered and clean DC power for radio equipment that hams have become dependent upon for powering their ham gear. Weak signal operations in ham radio communications require the lowest possible noise level that you can achieve.

Along came computers with inexpensive and lightweight power supplies. To obtain the light weight, the power supply was redesigned from a heavy iron type to that of a high power switcher. Switching power supplies are really high power oscillators operating at frequencies in the 2–50 kHz band. Because of the high power switching mode, noisy switching transients are generated that can cause a lot of radio frequency interference problems.

Having worked with switching power supplies over the years, I felt that some investigation was in order before suggesting that computer power supplies are suitable for "all" ham applications. I worked up a list of concerns as topics to investigate as indicated by the following:

- Available power output at 12 volts
- Load curve vs. voltage output
- Heat rise vs. load
- Sustained vs. intermittent power output
- EMI/RFI noise
- Voltage regulation
- Minimum supply load requirements
- Variable vs. fixed load characteristics
- Raising the 12 V output to 13.5 V

Although some of the concerns overlap, spelling them out provides "food for thought" and opens the door for an investigation. But by no means is the list complete, and it behooves any ham using a switching power supply

Power rating	+3.3 V	+5 VSB	+5 V	+12 V	–5 V	–12 V	+24 V
110 W		0.5 A	4 A	2 A	0.3 A	0.3 A	2.3 A
150 W			4 A	2 A	0.3 A	0.25 A	
165 W			15 A	6.3 A	0.8 A	0.8 A	
185 W	12 A		18 A	6 A	0.15 A	0.15 A	
200 W ATX	11 A	0.75 A	13 A	8 A	0.5 A	0.5 A	
230 W			23 A	9 A	0.5 A	0.5 A	
230 W ATX	12 A	0.75 A	16 A	9 A	0.5 A	0.5 A	
250 W	14 A	0.8 A	18 A	9 A	0.5 A	0.5 A	
250 W ATX	14 A	0.75 A	18 A	9 A	0.5 A	0.5 A	

Table 1. *Chart showing the output voltages and currents for several typical computer power supplies.*

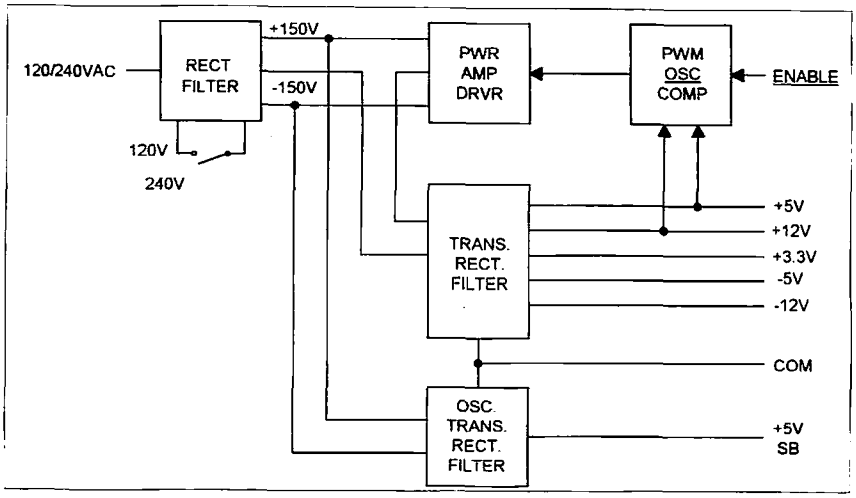

Fig. 1. Block diagram of a type ATX computer switching power supply.

to perform some experimentation to ascertain the suitability for the intended application.

It is my intention to address each of the above concerns as objectively as possible so that you, as a user, can make a judgment as to the suitability of the power supply for your application. My focus will be primarily on the 12 V output as it is the most logical source for powering ham gear.

Labeled power marking

With the wide variety of power supplies available, a ham has to choose one that will provide the desired output power. Most of the later-model power supplies are rated in the 180–300 W range, but since most ham radio equipment requires 12 VDC, only the 12 V output from the computer supply will typically be used. The label on the power supply provides a clue as to the total amount of power that the supply is capable of providing, but the 12 V output power is less. The average supply will provide 6 A at 12 V, which is 72 W out of the total of perhaps 200 W. Therefore, the usable 12 V output from the supply is 72 W regardless of the total power value marked on the label. The limiting factors involve the wire in the power transformer and the rectifiers used for the 12 V circuit. The chart shown in **Table 1** lists the voltage and current for several typical power supplies.

A block diagram of a typical switching power supply is shown in **Fig. 1** along with the wire color convention (**Table 2**) used on the later power supplies.

When using the power supply to power any piece of equipment outside of the computer, the connectors should be removed so that the wires of like color can be bundled for maximum current handling. Of primary concern are the yellow 12 V wires and the black ground wires. Voltage regulation is done on the board, not at the ends of the wires where it would be preferred. The objective of bundling the wires is to reduce the voltage drop between

Continued on page 12

+3.3 V	Orange	High current
+5 V	Red	High current
+12 V	Yellow	High current
+5 VSB	Purple	Standby — low current
-5 V	White	Low current
-12 V	Blue	Low current
COM	Black	Common — ground
PS-ON	Green	PS enable — ground to turn on PS*
PS-OK	Gray	Goes high when PS is "ready"
+3.3 V	Brown	3.3 V sense

***Table 2.** Chart of typical wire colors and functions for computer power supplies. *When used, the green wire must be switched to ground to enable the power supply.*

	(A)	(B)	(C)
	Normal ATX	Voltage Raised	
I load	Eo	Eo	Eo
0 Amps	12.31	13.94	13.89
0.5	12.23		
1.0	12.20	13.76	13.51
1.5	12.16		
2.0	12.13	13.60	
2.5	12.10		
3.0	12.08	13.45	
3.5	12.06		
4.0	12.04	13.30	13.36
4.5	12.00		
5.0	11.98	13.15	
5.5	11.96		
6.0	11.93	13.04	13.30
6.5	11.91		
7.0	11.88	12.92	13.25
7.5			
8.0		12.85	
8.5			13.18
9.0		12.85	

Table 3. Regulation response of three different power supplies as a function of a varying load. Supplies B and C had the 12 V output raised to nearly 14 V.

The Cheapest Supplies Ever

continued from page 11

the power supply board and the using circuit.

Load curve

NOTE: ATX and some later-model power supplies have a stand-by mode. The green wire must be switched to ground to enable the supply.

Table 3 shows data for a load test that I performed on one ATX power supply before the voltage was raised to 13.5 V, and for two other supplies after raising the output voltage.

Since most ham equipment operates in the 12.6-14.7 V range, I chose to raise the supply voltage to something close to 13.5 V to evaluate the load voltage vs. load current conditions in a manner similar to how the supply might be used by a ham.

To obtain a more consistent measurement, the output voltage was measured at the board end of the wire bundle with the load attached at the far end of the bundle. Yes, the voltage change value was greater at the load end, but not significantly such that it would reject the use of the power supply. My conclusion was that the computer power supply handles the load change from zero to full load, as one would expect from any equivalent power supply.

Voltage regulation by design for computer supplies is +/–5%. During my evaluation I found all of the supplies tested to exhibit regulation of the 12 V output to something closer to 1% (one volt out of 12) or better over a zero to full load variation.

Heat rise and sustained load

One of my early concerns about a computer power supply was the heat rise within the switching transistors as function of load. To monitor the temperature, I mounted a thermocouple onto the metal heatsink and watched the temperature variations as the power supply load was varied. A fairly long fully loaded heat rise test was performed on three power supplies, each with the 12 V output loaded to maximum indicated current. The results were interesting to say the least.

One power supply had previously been repaired and the switching transistors had been replaced with some that worked OK, but weren't designed for switching applications. As a result, the transistor Vsat (voltage across the transistor at saturation) was a little too high, allowing the transistors to develop a lot of heat. During the heat rise test, the heatsink hit about 150°F and thermal runaway began. It hit 200°+ before I could shut down the power. Replacing the transistors with the proper devices solved the heating problem.

Once the first supply was repaired, all three supplies used in the load test held a heatsink temperature of 75-80F° regardless of the load imposed on the 12 V output.

But let me point out an important thing that I observed during the load and heat rise test phase. The cooling fans used in computer power supplies appear to vary in the amount of air that they will move. In the first power supply that had the switching transistors replaced, I suspect the original failure was caused by poor airflow across the heatsink.

One of the advantages of raising the 12 V line to about 13.5 V is that it increases the fan speed; the resulting increased airflow does help the cooling.

EMI/RFI

Switching power supplies are well known for the amount of radio frequency noise that they are capable of producing. If you consider the fact that a 250 W switching power supply is in reality the equivalent of a 250 W transmitter in a small box, then the amount of noise emitted might be acceptable. But when you want "clean" power out of the power supply, your desire is to have the least amount of noise possible from the power supply. In other words, you want pure DC power, not DC power with a high AC ripple riding on the DC.

Computer power supplies were designed to meet Part 15 of the FCC regs and they most likely do. Unfortunately, I am not equipped to make an objective evaluation as to whether they meet Part 15, but did perform some subjective tests to see what I could determine.

My tests were made using two techniques involving a "voltage probe" and a "multiturn pickup loop." The loop is equivalent to a magnetic pickup probe. The voltage probe was an oscilloscope probe with the tip insulated. Each probe was connected to a spectrum analyzer with a sensitivity of 0.5 µV and capable of "looking" at signals from 30 kHz to 2 GHz.

The voltage probe technique worked OK as long as the probe was down near the switching transistors. But it failed to show up any switching noise when in the vicinity of the wire bundle or load.

The loop, on the other hand, was most sensitive to EMI, and I could change the sensitivity by changing the number of turns in the loop. I started the tests with one turn and finally ended up with five turns at a diameter of about 3/4-inch.

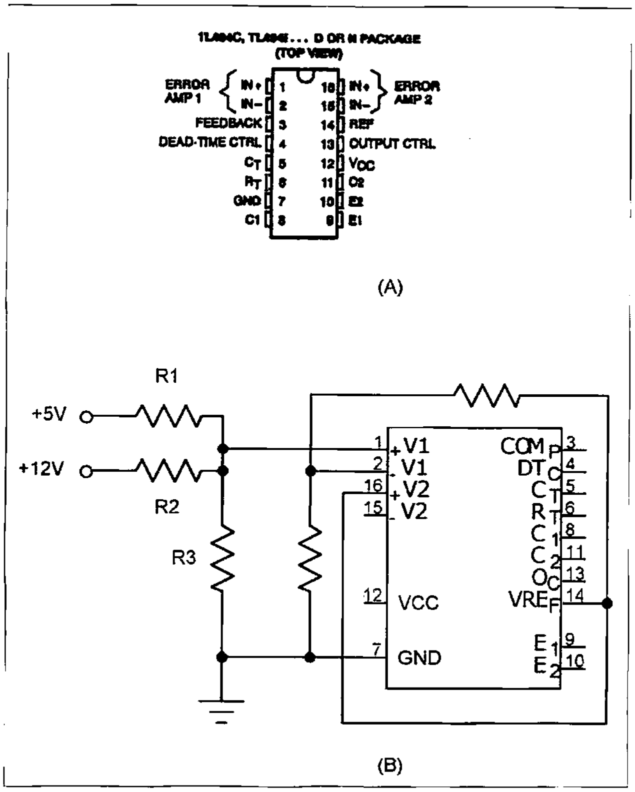

Fig. 2. Pulsewidth modulator/oscillator IC. (A) Top view of the TL494/LM494/NTE 2729 IC. (B) Typical output voltage sampling circuit for voltage regulation.

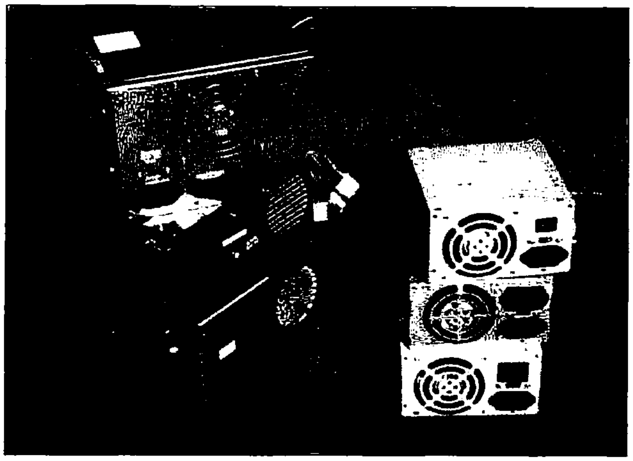

***Photo A.** A stack of typical computer power supplies.*

Probing next to the switching transformer, a strong carrier appeared at approximately 38 kHz and at equally spaced increments up the band. Amplitude attenuation did occur as a function of increasing frequency. Most all detectable signal levels ceased to be observable above about 100 MHz. One power supply did exhibit some "noise" up to about 200 MHz.

One thing that I did notice when placing the loop tightly into the wire bundle was that RFI was detectable with the supply cover tightly in place. Switching noise appeared to raise the analyzer's noise floor at various spots within the spectrum. I have no idea at the moment why the noise floor didn't remain consistent across the bands. Audibly, the noise sounded something like a skill saw cutting wood, with the highest level appearing in the 24-50 MHz region and nearly disappearing above 100 MHz.

My conclusion is that each power supply being considered for use in a ham radio environment would have to be evaluated as an individual. Each supply that I tested had differing characteristics, with some being extremely quiet just like a heavy iron-type supply.

Minimum load requirement

A computer power supply does require a minimum load for it to "turn on and operate." By design, the intended output to be loaded is the +5 V line (red wires). After trying various loads such as "active" as well as resistive loads, I determined that the desired load is a resistor. For each of the supplies that I checked for a minimum load requirement, I managed to get away with 0.5 A being drawn from the 5 V supply. But for reliability of starting, I found 1 A to be a better load. Choosing a resistor is pretty much dependent upon what might be available from the ham junk box. A 5 ohm 10 W (minimum wattage) resistor is desirable, but a number of 6-volt automotive light bulbs will also work, if light output is desired.

Operating with a minimum load on the +5 V line is almost "free" because it leaves the 12 V line available for a zero to full load application. Having a minimum load on the +5 V line appeared to not increase the heatsink temperature. In addition, the higher load current on the +5 V line helps when raising the 12 V output to 13.5 V.

Raising the 12 V output to 13.5 V

The output voltage does not have to be increased, as there are a lot of applications where the "normal" output in the 11–12 V range will suffice. But most ham gear designed for 12 V operation is designed to operate off a supply voltage source from 12.6-14.7 V, which is what a typical automotive electrical system will provide.

Some power supplies are easier than others for manipulating the output voltage. There is one caveat that must be considered before actually changing the output voltage. Since computer power supplies are designed to be inexpensive, there is very little margin built into them unless it is cost effective. Of primary concern is the voltage rating of all the output filter capacitors. Each should be checked by observing the voltage marking. As an example, when the 12 V output is raised, the 5 V output will also rise proportionally. If the 5 V filter caps are 6 V or higher, then the margin is OK as the 5 V line may increase to 5.5 V. The capacitors on the 12 V line hopefully are 16 V or higher.

Let's step back for a moment and look at the circuit operation and note how the output voltage is controlled/regulated.

The later model switching power

Continued on page 55

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Your Long-Lost Transistor Notebook

Part 3 of 4.

At this point in our tour of how transistors work, we've collected test data on unknown transistors found in a ham's "junk box." From the test data collected, we've developed characteristic curves, established a load line and, ultimately, a dynamic transfer characteristic curve.

The transfer curve provides us with the tool that's needed to develop a quiescent operating point, determine response linearity, a signal amplitude limit, stage gain, and the resistor values in support of Class-A amplifier design. We will treat each of these items as stops in our tour as we proceed forward in our design journey.

Power dissipation

All electronic devices, when used, dissipate heat at some level. In the case of transistors, the amount of heat dissipated must be kept within a safe operating region. One of the first steps in doing a transistor design application, is to assess the amount of power that will be dissipated and choose the appropriate transistor for the application.

As shown in **Fig. 1**, a power dissipation (Pd) curve is drawn across the set of characteristic curves, and all transistor operations must be restricted to the left side of the Pd curve. In most Class-A design applications, the load line is typically placed well to the left of the Pd curve.

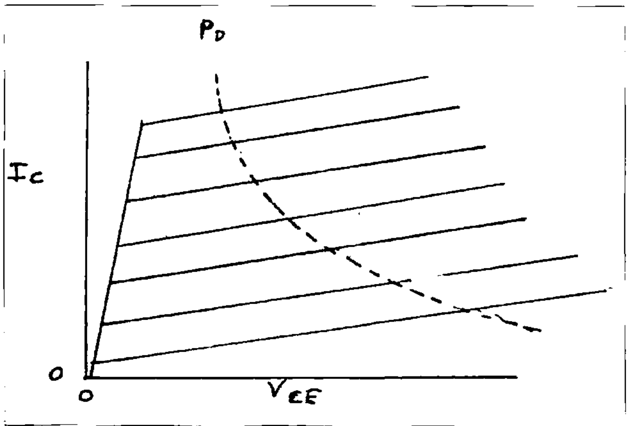

Fig. 1. A power dissipation curve is shown, which represents the maximum power a transistor can safely dissipate at any point within its operating range. The "safe" operating region is to the left of the Pd curve.

But in digital applications where the transistor is used in a switching mode, the load line may pass through the right side of the Pd curve. Even though the load line passes through the Pd curve, the ends of the load line are to the left of the Pd curve and those are typically the switch mode operating points. What this means is that the transistor is either conducting in saturation (maximum current) or cut off (minimum current).

As an example, a 2N2222 is a 310 mW device with a rated maximum current of 500 mA, but it isn't normally operated at that current because it would get very hot and possibly burn up when used in a Class-A mode. Yet, the transistor will operate well at 500 mA in a switching mode, where the Vce value may be as low as 0.4 V.

Small-signal transistors in a TO-92 plastic package typically fall into the 300 mW dissipation category. If we use the dissipation value for a given transistor and divide it by the Ic current values on the graph, we find the corresponding voltage points. These points allow us to plot a curve that represents the maximum power dissipation for that transistor as shown in the example of **Fig. 1**.

After a set of characteristic curves has been developed for a transistor, a single point assessment on the graph for power dissipation will determine if the set of curves is appropriate for a

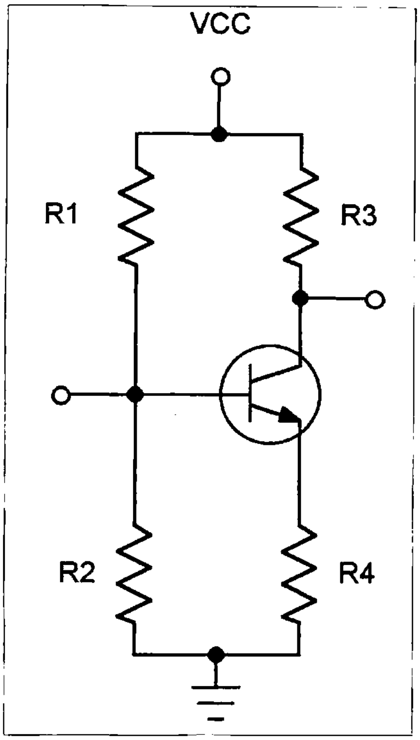

Fig. 2. Typical Class-A transistor amplifier stage that will be used as our design model.

Class-A application. To perform the assessment, select a single point near the center of the characteristic curve set and locate the corresponding Vce voltage and Ic current values from the axes. Multiply together the two values to obtain the power dissipation at that point in the set of curves. Let's say that your calculation has indicated a power of 100 mW dissipation at the point selected. Compare 100 mW to the transistor rating (if known) of perhaps 310 mW. The selected point is then 210 mW into the safe operating region for that transistor. With that information known, then drawing a Pd curve for that set of characteristic curves is probably not necessary.

Establishing a load line

Beginning our circuit design with the circuit shown in **Fig. 2**, we'll be able to work out all of the circuit details using characteristic curves. For this example, we'll be using the 2N3904 set of characteristic curves shown in **Fig. 3**.

The first step is to decide what power supply voltage (Vcc) level is to be used; let's use 12 V and see where it takes us. A pencil mark is made at the 12 V point on the Vce axis of the graph.

The next step will be to determine an available resistor value suitable for R3. OK, let's stop for a moment and see what it is that we're attempting to do with this step. It's desirable to use common resistor values in the design, and that means some compromises will be made along the way. Supposing that we choose three resistors, 10k, 4.7k, and a 3k to see how they'll work in the circuit when placed in the R3 location.

The next step is to make an assumption that if the transistor were shorted out, how much current would flow through the selected resistor with 12 V applied? Using the 3k resistor, a current of 4 mA would flow,

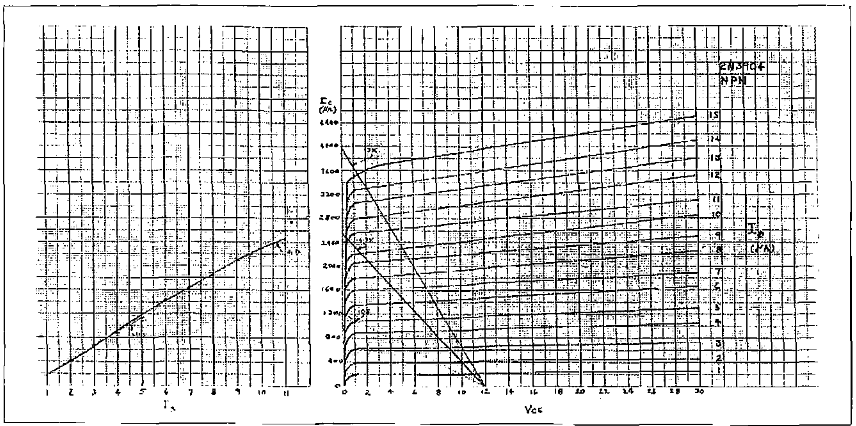

Fig. 3. Load lines and dynamic transfer characteristic curves for a 2N3904 transistor.

Ib	Ic
8	1820
4	910
delta = 4	910
gain = 910/4	227

Table 1. Stage gain values.

almost 2.6 mA for the 4.7k and 1.2 mA for the 10k.

Having those current values, then place a pencil mark at those values on the axis and draw a straight line between the Ic point and the 12 V point. The three lines now represent three different load lines from which you may select one for a final design.

Using each of the load lines, a corresponding dynamic transfer characteristic curve is drawn to assess the appropriateness of each resistor selection. **Fig. 3** shows the overlay of the three transfer curves; by my eye evaluation, they all appear to be reasonably straight except that the 4.7k tends to curve downward slightly toward the high current end. To use the resistors, we'd have to limit the operation to the linear portion below the curved section. With the exception of the curved section, then any one of the resistors may be used in the design.

So, which resistor should be used? It's a matter of choice, and the choice can be made using some insight into what the transfer curve information provides. Take note of the length of the transfer curve for each resistor, and also take note of the base current (Ib) values. The range of Ib values for each determines the input signal swing amplitude that the circuit will accommodate. Another consideration is the amount of collector current that the stage will draw from the power supply. If the power supply is to be a battery where only a meager current is available, then the lower the Ic value, the better, but the signal amplitude will be limited accordingly. See, there are trade-offs that have to be considered, and only you can make them in order to meet your design objective.

Stage gain

Let's choose the 4.7k resistor for the R3 location and see what else we can determine from the selection. Stage gain is a parameter of interest because it will provide an indication as to how much the stage can be expected to amplify a signal. Stage gain is an AC parameter and is typically referred to as a DELTA function, meaning that it is a variable characteristic. To find the gain, start by selecting a point near the center of the load line or the transfer curve, then select a base current value about two

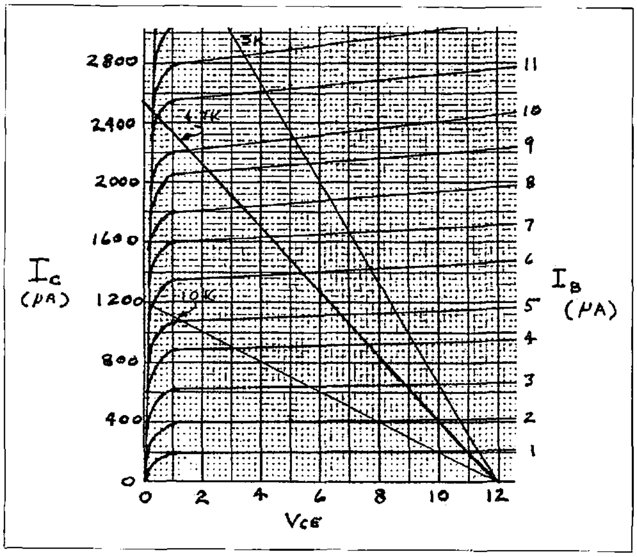

Fig. 4. Calculating stage gain near the midpoint of the load line (see text for details).

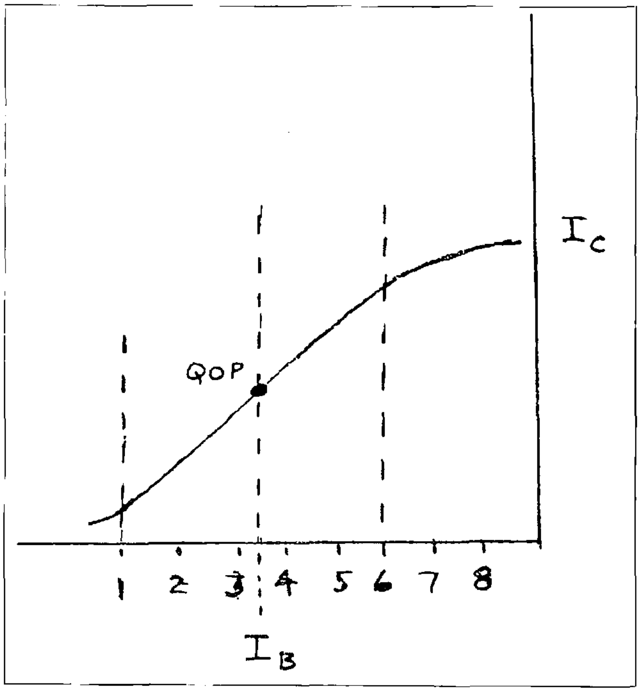

Fig. 5. A dynamic transfer characteristic curve with exaggerated distortion.

steps to either side of the center point. Using the graph shown in **Fig. 4**, I've chosen the values in **Table 1**.

With both currents in microamps, the calculation is straight division, and the resulting gain is called CURRENT GAIN. The actual stage gain, if viewed as a voltage amplitude, will most likely be reduced some from the current gain figure.

Changing the load line slope will also affect the stage gain. As in the same example, the 10k resistor having a lower slope will realize a slightly higher gain, while the steeper slope of the 3k will be slightly lower.

Linearity and QOP

We've been talking all along about the linearity of the transfer curve and now it's time to consider how it applies to the operation of the amplifier. **Fig. 5** shows an example of a distorted transfer curve having a straight section between an Ib of 1 to 6. For a linear response expected from the amplifier it is necessary to limit the base current excursion between the two max limits of 1 and 6. Any amplitude swing beyond those limits will create distortion in the transferred signal.

To keep the signal peaks centered within the linear response region, a suitable bias point must be established. This bias point is called QOP (quiescent operating point) and is located at the midpoint of the linear operating region of the transfer curve. Referring to **Fig. 5**, QOP could be placed at an Ib of 3.5.

With those examples in mind, let's return to **Fig. 3**'s transfer curve and find a suitable QOP. Again, using the 4.7k resistor for R3 and taking into account the distortion that's observed, perhaps the suitable operating range is between Ib values 3 and 9 microamps, placing QOP at the midpoint of 6 μA. The value of 6 μA is the resting base current that we'll need to know for setting up the base bias resisters R1 and R2 as shown in **Fig. 2**.

What's next?

At this point in our tour, we've developed the tools that we now need to work

Continued on page 55

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Build the PSK-20 QRP Kit

This transceiver is a Small Wonder.

In the past few years, kit building has once again become very popular. There was a time decades ago when kit building was not only very popular, but a way for many hams to save money. Companies such as Heath, Allied Radio, and Eico are legends today among the older generation of hams — myself among them. Today, the number of options available to the prospective kit builder gets greater all the time. And kits still provide an inexpensive and rewarding way to become active on the airwaves.

Small Wonder Labs has been selling easy-to-build and highly functional kits since 1994. The PSK-20 is one of the more recent additions to their lineup. As kits go, the PSK-20 is in a class by itself. It's a crystal-controlled QRP transceiver designed expressly for use with a computer for operating PSK31. It can also be used for other digital modes that use a computer's sound system to decode and generate the audio.

Technical details

The complete PSK-20 transceiver is built on one double-sided circuit board. This single board contains all that's required, in addition to your computer, to operate PSK31 on 20 meters. A fixed-frequency, crystal-controlled, superhet receiver with a slightly broader than normal passband covers the unofficial PSK31 subband of 14.069 to 14.073 MHz. Being fixed-frequency means that there is no tuning control on the PSK-20; the software (such as DigiPan) handles all the tuning within the PSK31 subband.

A 3-watt PEP transmitter provides enough power to make worldwide contacts when fed into any reasonable antenna. The PSK-20 also contains T-R switching circuitry that allows the computer to handle the switching chore automatically through the computer's serial port.

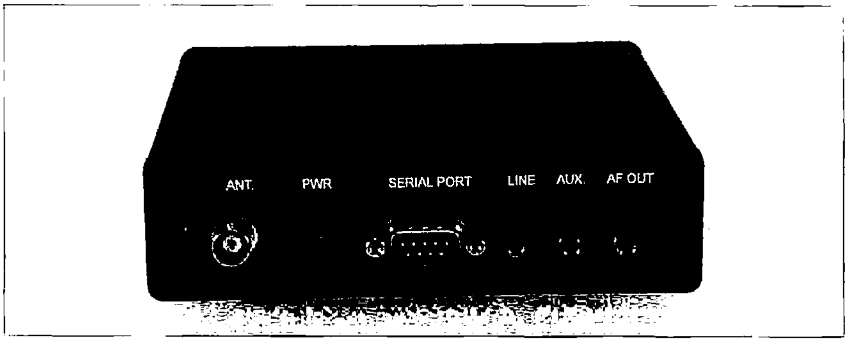

Photo A. The PSK-20 front panel.

The building experience

Extensive building experience is not required to successfully assemble the PSK-20. However, some experience with a soldering iron and working with printed circuit boards would be very helpful. No special tools are required — only the usual assortment of wire strippers, cutters, pliers, and screwdrivers.

The manual is nicely organized into nine assembly groups. Each group focuses on a particular section of the circuit board. The manual provides a clear color diagram for each group's parts location. Each individual step includes a good description of the part to be installed, limiting your chances of mixing up parts. I found the amount of time to assemble each group to be just about right for an evening's or morning's work before moving on to other necessary chores. Those who have more time available might do two or three groups in a sitting.

Receiver alignment is a snap if you use the DigiPan software and have a "big rig" available to provide a calibration signal. The transmitter alignment is done most easily with a wattmeter and a DVM (digital voltmeter). If you don't

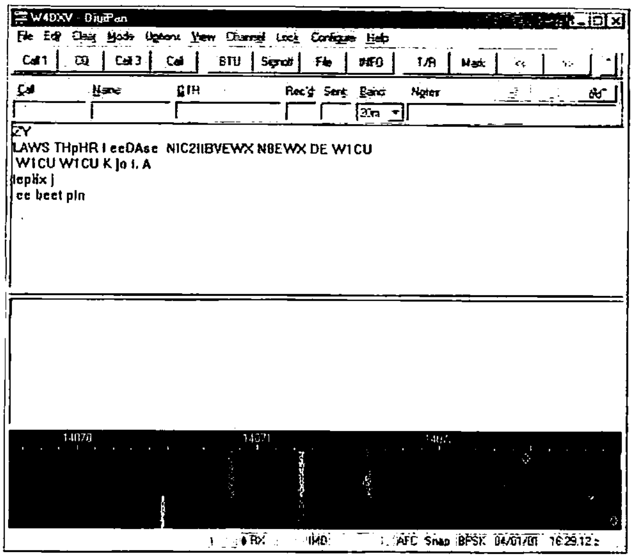

Fig. 1. Screenshot of DigiPan.

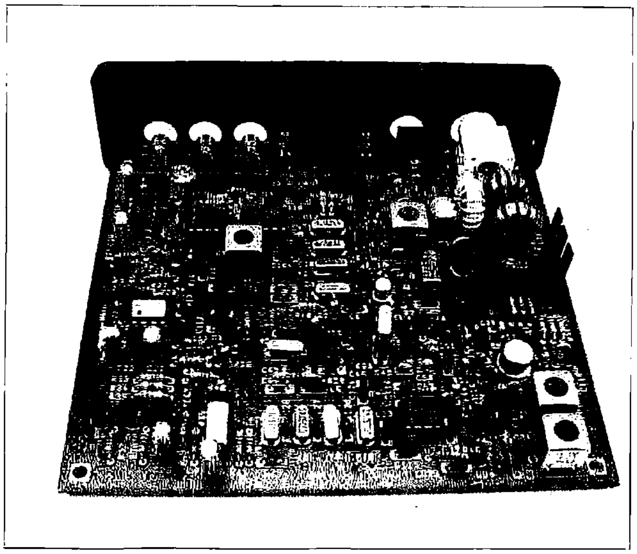

***Photo B.** The PSK-20 circuit board.*

have these, an alternative is provided. There is a location on the circuit board where you can install a common LED that will then serve as a power output indicator.

Should something go wrong, the manual contains a section on troubleshooting, and additional troubleshooting information can be found on the Small Wonder Labs Web site.

Setting up for operation

The PSK-20 is very straightforward to set up. All that you need in addition to the transceiver is a few cables. You can either make these yourself or purchase them at your local Radio Shack. A serial cable 9-pin on one end, and either 9-pin or 22-pin on the other end, depending on the requirements of your computer, provides transmit-receive switching. Two 3-conductor cables (2 conductors and a shield) with 1/8-inch stereo miniplugs provides the transmit and receive audio interfacing between your computer's sound system and the PSK-20. One cable goes from the PSK-20 "AF-OUT" jack to either the microphone or line-in jack on your computer. The other cable connects the audio output from your computer, taken from the speaker-out jack, to the PSK-20 "LINE" jack. There is an additional jack (AUX) on the front panel of the PSK-20 that you can use to feed your existing computer speakers.

I opted to make my own serial cable. I had a couple of 9-pin female plugs in the junk box. Adding some 2-conductor shielded cable, I wired 3 pins — Ground, DTR, and RTS. This is all that's required to allow your computer to control the PSK-20. In fact, only DTR or RTS is required, but I implemented both for redundancy.

DigiPan with the PSK-20

Once your computer is properly connected to the PSK-20, you will need one of the many available programs that support PSK31. The most popular, and the one recommend by Dave Benson, designer of the PSK-20, is DigiPan. This is an excellent program for PSK31 and works great with the PSK-20. It's also free, which is quite remarkable considering how well it works. You can obtain your free copy of DigiPan by browsing to the following Web site: [http://members.home.com/hteller/digipan].

The bottom line

As soon as I completed the PSK-20, I was anxious to see how well it worked. After firing it up, I picked out a signal on DigiPan's waterfall display and, sure enough, it was a CQ. After we established a QSO, the other station turned out to be running 5 watts from a hotel room in Long Island with an indoor antenna. The capabilities of PSK31 are truly amazing. Since this contact I have made dozens more and continue to be impressed with the simplicity of the PSK-20 and ease with which I can make contacts.

The PSK-20 represents a great way to combine kit building, QRP, and PSK31 operation. It's an extremely compact, yet highly capable single-function transceiver that's fun to build and relatively inexpensive to own. Whether you're a first-time kit builder or an old hand with the soldering iron looking for a convenient way to get into digital modes, the PSK-20 is a great kit.

For more information on the PSK-20, visit the Small Wonder Labs Web site at [http://www.smallwonderlabs.com] or drop Dave Benson an E-mail at [dave@smallwonderlabs.com].

Pricing

(Prices include shipping within U.S.)
PSK-20 kit: $100.
Optional enclosure: $30.
PSK-20 with enclosure, wired and tested: $195.

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Movable Microphone Boom

Why not operate like a pro?!

The classic architect's lamp is a simple, inexpensive, and effective way to suspend a light source over a desk or workbench. By making some minor changes, it becomes equally effective at holding your microphone right where you want it.

Have you ever been to a commercial radio station? Or perhaps seen one on television? If you have, you may have noticed the convenient way in which the announcer's microphone is suspended. It provides far greater freedom of movement then the typical fixed desktop microphone most of us use.

In this article I'll describe how you can obtain the same level of convenience for your station without spending a whole lot of your hard-earned money. The ingredients required are readily available from your local home supply or office supply store. You will need a few additional parts, either from your junk box or from your local Radio Shack.

The idea for this project came from my nearly lifelong friend Mike WB2IVN, who could never seem to find a comfortable position during our frequent marathon QSOs. (Though Mike and I have known each other for well over 25 years, we have yet to run out of topics to fill out a multihour QSO almost any evening the propagation gods are cooperating.) His problem stemmed from being forced to assume a hunched-over position to remain close enough to the microphone to achieve proper audio. After an hour or so of this, his neck and shoulders began to complain. Having worked the occasional contest sitting in a similar position, I was very sympathetic.

A light comes on

I love finding a problem to solve. And the solution, oddly enough, was suspended right before my eyes! In my

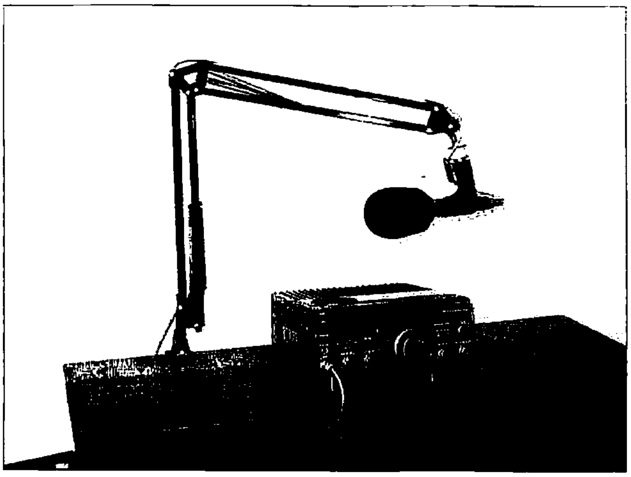

Photo A. *The modified architect's lamp holding a Yaesu MD-1.*

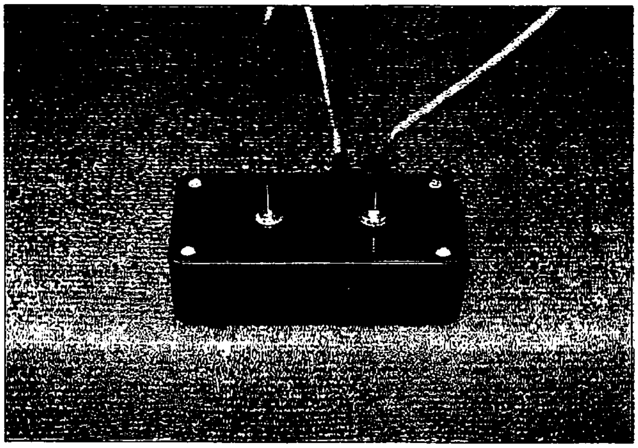

Photo B. *Simple push-to-talk switchbox with toggle switch and push-button.*

Qty.	Description
1	Architect's lamp
1	SO-239 (RS #278-201)
1	Plastic microphone holder (RS #33-4005)
1/2 in.	Schedule 40 1/2 in. PVC
2	4-40 x 3/4-in. machine screws
2	#4 lockwashers
2	4-40 nuts

Table 1. Parts list.

shack, I have a number of the ubiquitous and inexpensive architect's lamps. There's one by my computer desk, another suspended over my workbench, and yet another lighting my operating desk.

All I needed to do, I reasoned, was to find a simple way to adapt a common architect's lamp to hold a microphone, and *voilà!* Problem solved. As it turned out, it was even easier then I had expected. Picking through my junk box, I pulled out a common SO-239 chassis-mount UHF connector. Looking it over, it occurred to me that it might be exactly the item to make this project work.

Luck was with me. A simple, garden-variety SO-239 turned this project into a virtual no-brainer. The threads on a standard plastic microphone holder just happen to match the threads on an SO-239. With a few common additional parts and a little assembly work, your project can be complete before that first cup of morning coffee gets cold. Here's how to construct your own spring-loaded, professional-looking, "holds it in any position" microphone boom.

A plan comes together

The heart of this project is, obviously, the architect's lamp. These are available almost anywhere desk lamps are sold. When you're out shopping for yours, you will notice that there are two distinct varieties to choose from. The first type, which is what I recommend you obtain, uses a metal flange to attach the socket assembly to the arm. The second type uses plastic components. The metal type is more suitable. However, you may find that the plastic type is more common. The few plastic types I've examined look like they will lend themselves to this project adequately with a little extra ingenuity.

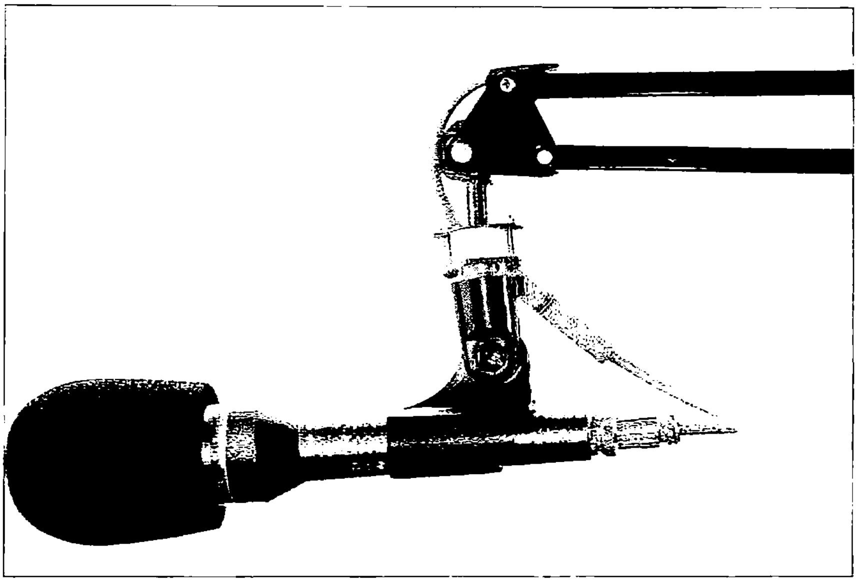

Photo C. The modified flange with PVC spacer and microphone holder.

To build your microphone boom, you will need to create one custom component. This part will be used as a spacer and is made from a 1/2" length of common 1/2" schedule 40 PVC pipe. (I always keep some PVC pipe around because I find it a useful ingredient in many different types of projects.) This spacer can also be made from any other type of tubing with a proper diameter. After creating your spacer, you can prepare the lamp for modification by removing the reflector, socket, and line cord. Then drill out the rivets holding the socket housing to the arm. Note that the mounting flange is slightly curved to fit the surface of the lamp housing. Carefully flatten out the flange with a pair of pliers.

Notice that, amazingly, the distance between the two rivet holes (approximately

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Read All About It!

Part 10 of good stuff from The Hertzian Herald.

More about Please QSL! and Cat Goes on the Air

The walk out to the mailbox this afternoon wasn't even worth the effort. The catch was totally disappointing: a missing-children card, two political flyers, the gas bill, a catalog from a local discount store, and a sheaf of pizza coupons.

You know, yesterday there was a QSL card sandwiched in between the junk mail, and it "saved some part of a day I rued," as Robert Frost would put it. It had been a rather ordinary QSO, and I hadn't asked for a QSL. But we were both teachers, and we had commiserated about the joys and frustrations of the job. He wrote on the card how much he had enjoyed talking about it. For a twenty-cent stamp he put a much-needed bright spot in my day.

Hey, for twenty cents I can put a bright spot in someone else's day. The group I chat with on two meters nearly every day on the way to work — we've had a hundred QSOs, but we've never exchanged QSLs. Why, I'd not only appreciate a card from some of those guys — I'd post it on my bulletin board. I'll send out a few cards, and I bet some of them end up posted on the walls of my buddies' shacks around town.

And while I'm at it, I'm going to send out a few cards as thank-you notes to some of the hams who have been especially helpful — whether we've QSO'd or not. Let's see, there's the radio club president, the newsletter editor, the trustee of the repeater, the VE who gave me my license exam, and the control op for the net I check into once in a while.

And let me not forget to send a QSL as a thank-you to my Elmer who helped me get on the air all those years ago. I haven't even seen the guy for over three years, but I bet it will make his day if I look up his address on the Net and send him a card. I'll date it back to April 1958, when he was my first QSO, and remark on the DX of two city blocks.

And the next time I have just an ordinary good QSO, I think I'll send the ham a card. And I won't just put down a signal report and my rig and antenna dope. Heck, one rig is pretty much the same as another these days, and nobody's interested anyway. Instead, I'll put down a little note to remind him of what we talked about, and how I enjoyed chatting with him. Or I'll tell him that he has a good, easy-to-copy fist. Or I'll say that I learned something from him. Maybe I'll put down my E-mail address and invite him to E-mail me for a sked, or just to continue the ragchew.

When you think about it, where else but in ham radio can you do anything at all for twenty cents? But with a QSL, you can put a big smile on somebody's face for just two thin dimes and a few strokes of a pen.

Cat Goes on the Air

"Dan, come down for supper. Now! I've been calling you for fifteen minutes."

"Right away, Mom," I yelled down the stairs. It was my turn to transmit, so I tapped a quick "QRT FR CHOW — 73" to Doug and Al on my hand key, and ran downstairs. I left the rig on, thinking I'd be back in half an hour.

It was 1958, and I had just started my sophomore year in high school. I'd

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gotten my Novice license six months before, and for the past six weeks had been meeting Doug and Al on 3718 kc nearly every day after school. We were from three different high schools, although our houses were each little more than a mile from the others. We had been arguing the merits of straight dipoles vs. folded dipoles, and I left the *Handbook* standing propped up behind the key, where I had been sending quotes from it to prove a point.

Now I must tell you that we had an alley cat named Mr. Thompson who had a serious problem with cold weather. He would climb under the bedcovers with you if you let him. He always sat on top of the hot-air register in the kitchen floor. He sometimes came up from the basement smelling of singed hair, and we knew he had been sitting on the main hot-air duct from the furnace again. He had a crooked tail from getting it caught in the fan belt of the car one winter day; he had been sitting on the engine block to keep warm, and got a big surprise when Dad started the car.

Well, it was a chilly fall day, and Mr. Thompson had been chased off of every source of heat in the house — until he found my DX-35 transmitter, still power-on. Of course, he attached himself to the top of it like a barnacle, blocking the vent holes. And on his way up he managed to knock over the *Handbook*, which fell on the key knob, putting a steady 65-watt howl on 3718.

Why hadn't I switched the rig to Stand-by? Good question. Why, oh, why, hadn't I switched the rig to Stand-by?

Doug and Al had been carrying on the QSO, naturally — having moms, perhaps, who were not so serious about family dinner time. Since our houses were as close as they were, our signals were mutually obliterating, so when the cat turned the carrier on they knew it could only be me.

They tried getting me on the phone, but as luck would have it, my younger sister had been home sick that day, and being excused from the dinner table, was using the opportunity to do some extended chatting with her best friend, with whom she chatted endlessly every day anyway.

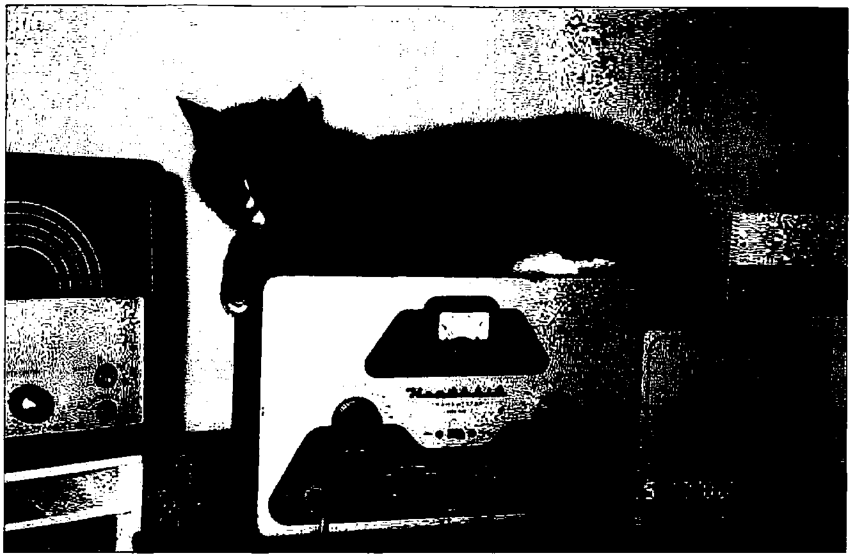

Photo A. Here is the DX-35 that survived the transformer blow-up in 1958. No, that's not Mr. Thompson on top; it's K8JWR's cat, Morgan, keeping warm.

Consulting with one another by phone, Doug and Al reached the conclusion that I must have taken the rig out of the cabinet to mess with it again, hit the 600 volts, and was slumped over the key dying of electric shock. They agreed to hop on their bikes and pedal to the rescue.

Meanwhile, Mr. Thompson was growing more and more comfortable as the rig overheated. The plates of the 6146 final glowed orange, then red, and Mr. Thompson began to notice a peculiar odor. Now Mr. Thompson was fatally curious, as his breed is said to be, and in his case this was especially true in matters olfactory. So we can imagine that, at about the time the transmitter was approaching the limit of the thermal abuse it would tolerate, Mr.

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Build This Narrowband Tunable Filter for Receiving PSK31 Signals

— or at least think about it.

*In an earlier article (see the list of references) on the tunable frequency crystal filter, it was pointed out that the design equations for a ladder filter permit you to develop a tunable frequency crystal filter. A schematic is shown in **Fig. 1**. You may select a 3dB bandwidth (BW3) and a shape factor (1/rov3). Different shape factors produce differing levels of asymmetry in the filter skirts. However, the filter's center frequency also shifts as the shape factor is changed.*

From the design equations you can pick a particular shape factor for any desired shift (within rather narrow limits). From there you can calculate the values of coupling and parallel capacitors and a termination resistance for the filter.

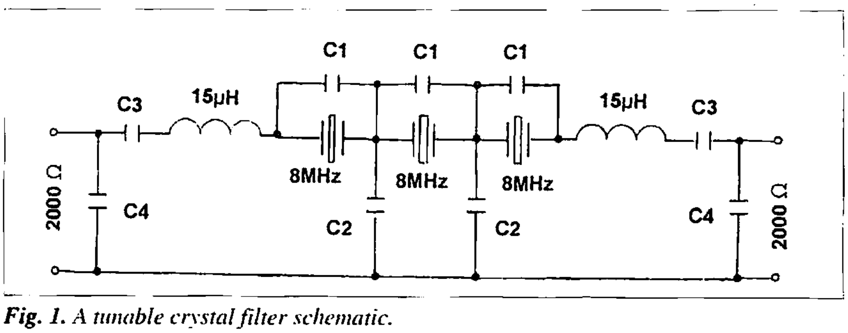

Fig. 1. A tunable crystal filter schematic.

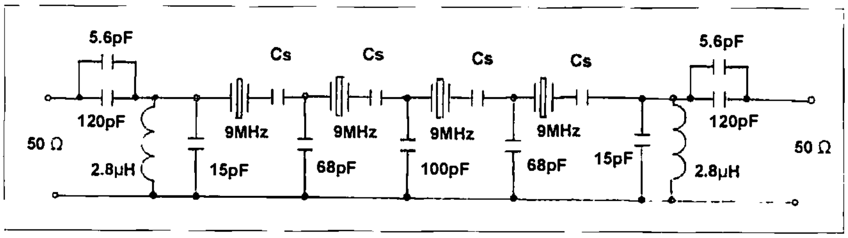

Fig. 2. Tuning the center frequency with series capacitors by G3SBI.

Unfortunately. the calculated termination resistance changes as the center frequency of the filter is shifted. Normally the circuits in a receiver which connect to the filter expect a constant termination resistance. You therefore need to introduce an adjustable impedance transforming network at each end of the filter. A controlled-Q L-network as included in **Fig. 1** can be used.

By adjusting the capacitors in a controlled-Q L-network you can maintain a constant overall end impedance as the internal termination resistance varies. This is the method used in the earlier paper. A fairly large number of capacitors (those labeled C1 through C4 in **Fig. 1**) therefore need to be adjusted simultaneously as the center frequency of the filter is varied.

A similar approach could be used with the upper sideband ladder filter, yielding even a greater shift as noted in the book listed in the references.

Another method of shifting the center frequency of a crystal filter was reported in a paper by Hawker. A capacitor Cs is placed in series with each crystal. See **Fig. 2**. This shifts the center frequency higher without introducing too much distortion into the overall filter shape.

The fixed capacitors Cs could be replaced with variable capacitors — however. both ends of all capacitors must be isolated above ground. Floating voltage

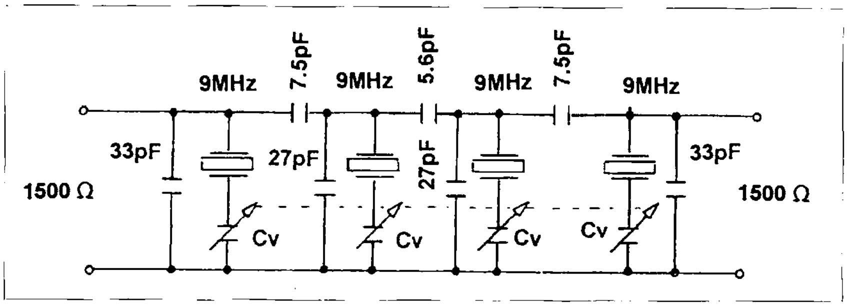

Fig. 3. Tunable crystal filter for PSK31.

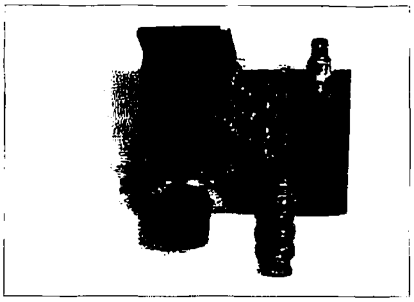
Photo A. Photo of PSK31 filter prototype.

variable capacitors may also be used as explained in the first paper.

A Narrowband Tunable Filter

The upper sideband ladder filter offers a unique opportunity for series-tuning because with this type of filter one side of all the crystals is normally connected to ground. A variable capacitor inserted in this connection for tuning can therefore have one side connected to ground. This is a common arrangement for ganged variable capacitors. See **Fig. 3**.

Some preliminary calculations using the information in the reference book indicated that it might be possible to shift a 4-pole 9 MHz filter with a 500 Hz bandwidth, up to 2.5 kHz to the right. This makes a nice filter for the PSK31 mode, where panoramic reception using a wide — e.g., 2.5 kHz — filter is the norm.

A screen capture of the DigiPan PSK31 software (see the March 2001 issue of 73) running on my laptop computer is shown in **Fig. 4**. From the bottom half of the waterfall display we see several signals within a 2.5 kHz passband (from 500 Hz to 3 kHz). There is a very strong PSK31 signal at 875 Hz and a strong RTTY-like signal centered at 1550 Hz. These two strong signals are activating the receiver's AGC action. Note especially the two weak PSK31 signals at 2700 and 2800 Hz. The one at 2800 is almost invisible in the display because of the AGC action of the receiver.

Halfway up the waterfall display, a 500 Hz bandwidth crystal filter was switched in to replace the wider filter. The filter is tuned so that signals with an audio tone of 2600 are centered in the filter. Note that the two strong signals are completely eliminated and the weak PSK31 signals at 2700 and 2800 are now quite visible. Either one can now be decoded with no interference from the stronger signals. It seems that for the PSK31 mode you want to have both a wide bandwidth filter for the panoramic display to first locate some potential stations to work, and also a tunable narrowband filter to switch in to eliminate interference and bring the desired signal up out of the noise.

The tunable filter with 9 MHz crystals of **Fig. 3** was designed to present a 1500-ohm termination resistance. It can therefore be switched in place of the wider 9 MHz filter commonly used in the IF of fixed tuned PSK31 receivers such as the one described in the last reference at the end of this paper. **Photo A** shows the actual construction of the prototype filter of **Fig. 3**. A variable capacitor with 5 identical sections (only 4 are used in this filter) is mounted on a circuit board, foil side up, along with the crystals and fixed capacitors. Each section of the variable capacitor has its rotor grounded through the common tuning shaft. A 180-degree rotation shifts the capacitance of each section from 168 pF with the plates fully meshed down to 10 pF with the plates completely opened.

The crystals used are 9 MHz series units from Digi-Key, part number

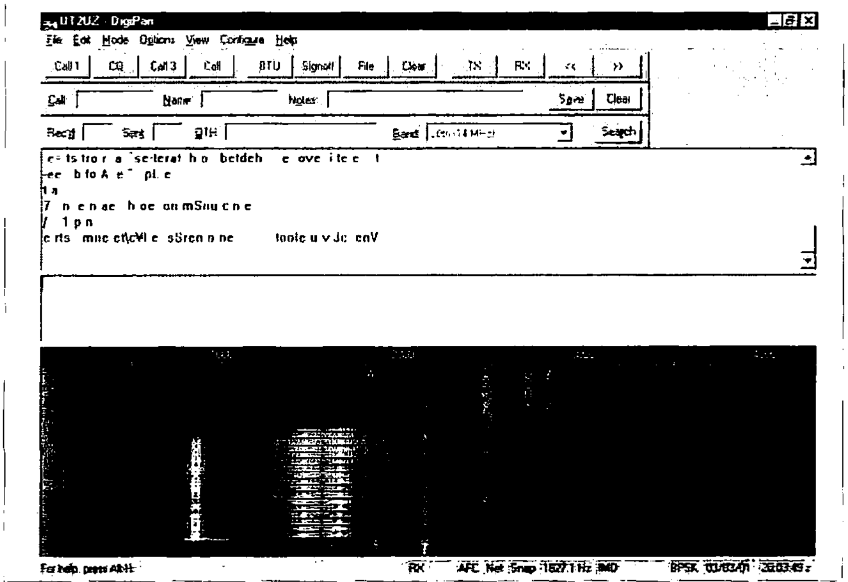
Fig. 4. Screen capture of DigiPan software.

	fs	fp
crystal #1	9,000,027	9,000,770
crystal #2	9,000,076	9,000,809
crystal #3	9,000,136	9,000,841
crystal #4	8,999,958	9,000,739

Table 1. Frequency measurements of the four crystals used in the filter.

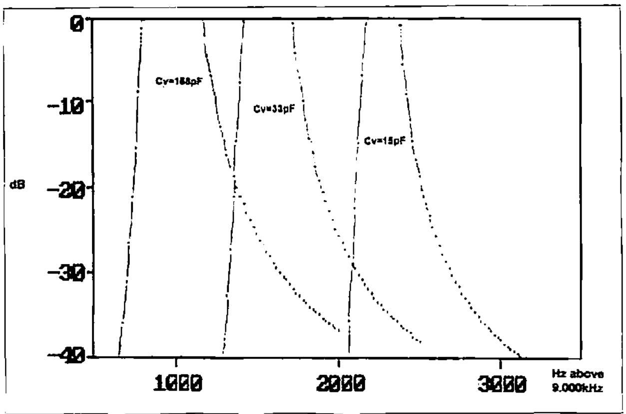

Fig. 5. Calculated frequency response of PSK31 filter for three different values of Cv.

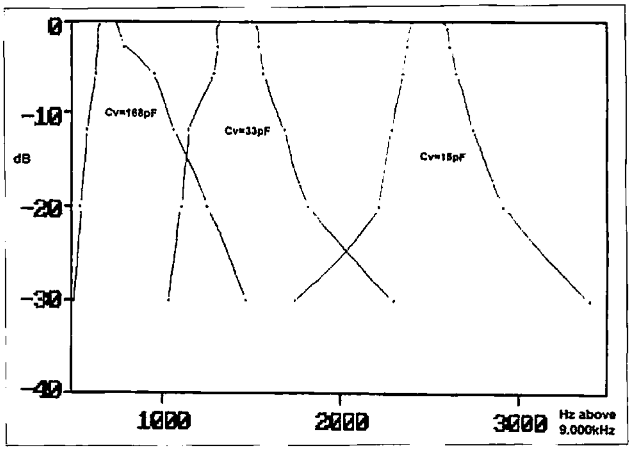

Fig. 6. Actual measured response of PSK31 filter.

X419. See **Table 1** for the actual measured frequencies of the four crystals used in the filter.

For this narrowband filter the crystals should be matched to within ±100 Hz if possible (±50 Hz is even better).

Fig. 5 shows the calculated frequency response of the filter for three different values of series capacitance, 168pF, 33pF, and 15pF. Calculations were made for frequency steps of 20 Hz. In **Fig. 6** the actual measured response for the variable capacitor set for these same 3 values is plotted. The measured points are indicated by dots on the plot. The center frequency of the filter can be tuned to any point in the 2.5 kHz range by adjusting the variable capacitor.

In order to take these measurements, a 9 MHz signal source with vernier (very fine) tuning is needed. A special generator was constructed using a string driven tuning disk. **Photo B** shows the measurement setup. A sensitive RF dBm voltmeter and step attenuator such as the Black Forest units shown in the photo will be needed. These units are available in kit form from Unicorn Electronics, [http://www.unicornelex.com], 1-800-221-9454.

For even better performance, you could also design a tunable filter using 14070 MHz crystals and place it between the antenna and RF input of any radio. Use the design equations in the *Ladder Crystal Filters* book. Placement at this point would also help to prevent intermodulation generation between two or more strong signals within a wide panoramic passband but rejected by the narrow filter. Again, tuning is essential to allow you to emphasize the desired (weak) signal and reject the others.

References

1. "The Frequency Tunable Crystal Filter," *Communications Quarterly*, Summer 1993, pp. 29-35.

2. "G3SBI's H-Mode Receiver Design," Pat Hawker, *Communications Quarterly*, Fall 1994, pp. 81-94.

3. *Ladder Crystal Filters*, John Pivnichny, MFJ Enterprises, 1999. Available from Barnes and Noble.

4. "The Digital Port," *73 Amateur Radio Today*, March 2001, pp. 50–52.

5. "A Panoramic Transceiving System for PSK31," *QST*, June 2000, pp. 31–37.

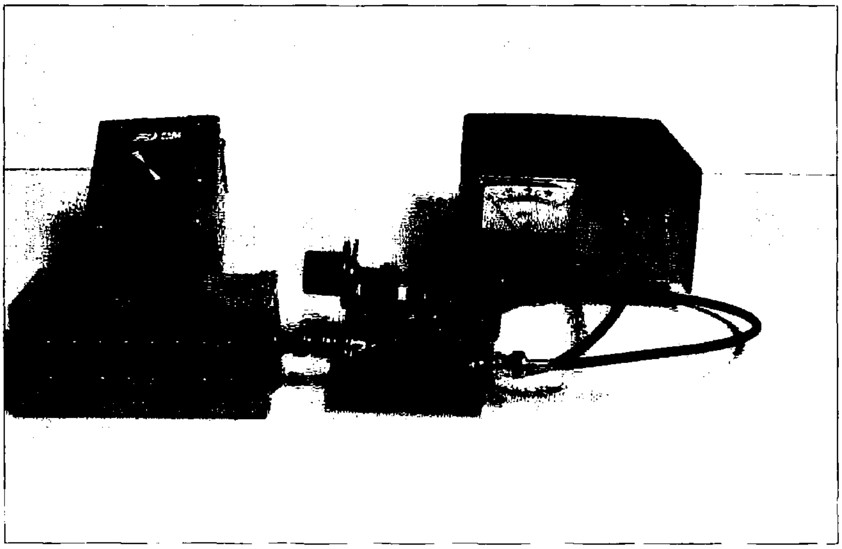

Photo B. Photo of measurement setup.

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One More Hospital Test

This time, you play doctor.

With Y2K safely behind us, this may be an opportunity to review the lessons learned in the course of the preparations we all made. In the amateur radio press over the past couple of years, there have been several mentions of the potential for RFI between ham emissions and the other electronic devices in the area. These might include medical monitoring or patient care devices in the hospitals we might have served this past New Year's Eve.

My full-time employment is as a Registered Nurse in the Emergency Room and the Intensive Care Unit of a rural hospital. I use an Alinco DJ-S11 2-meter handheld to monitor the local ambulance dispatch, so that when the paramedics are sent out, I have an idea of what is likely to come in to our small ER. I also use a pair of Audiovox FRS-130 Family Radio Service handheld radios to be able to contact one of the doctors who may not be present in the department, without the need for paging him overhead. My supervisor had some concern that there might be some interference between these 460 MHz radios and the wireless cardiac monitoring equipment the hospital uses, so I conducted a test.

Family Radio Service (FRS) radios operate on 14 frequencies allocated to simplex two-way unlicensed operation by the FCC. They have an output power of 1/2 watt FM-modulated signals on interstitial frequencies in the spectrum otherwise occupied by the General Mobile Radio Service (GMRS), lying between 462 and 463 MHz. The telemetry units used in this hospital are manufactured by Spacelabs, and operate on 2 mW on channelized frequencies between 460.6625 and 469.9625 MHz. They encode the cardiac signal in an FSK scheme, with ±6 kHz deviation. The signal is received on pairs of antennas located throughout the patient care areas of the hospital, for a diversified antenna scheme. The signal is then decoded and processed before a computer analyzes it and displays the EKG trace on a CRT for the nurses to monitor and assess.

I took one of the FRS handhelds (s/n 903120621), verified that it was functioning, and obtained two telemetry units not being used to monitor patients (telemetry unit #497, s/n 341004065, manufacture date 9/92, and telemetry unit #492, s/n 341004060x, no manufacture date identified on the unit). Sitting in our ER, I connected one to myself (to provide a signal to be tested for interference), and connected the other to a nursing student taking his rotation in our ER. With the antenna of the radio at a distance of 3 inches to 24 inches from the wires of the telemetry unit, I keyed the transmitter, simultaneously speaking on the telephone with the ICU nurse on duty regarding the presence or absence of interference to the signals she was observing. I rotated the antenna with regard to the patient monitoring cables of the telemetry units, and intermittently keyed and unkeyed the transmitter. The ICU nurse reported no change in the signal received from the telemetry units I was testing, and no interference to the telemetry unit on a patient one floor above us on the patient care unit, on telemetry. This was repeated with changes to the orientation of the antenna with respect to the telemetry monitor wires, and again no change in the signal was reported.

Subsequently, I repeated these explorations with the handheld located in the ICU nursing station, and beneath two telemetry antennas installed in the ceiling of the station. I ensured that there were fresh batteries in the radio, and stood beneath the antennas. With the ICU nurse observing the monitor, I keyed and unkeyed the radio on all 14 of the FRS channels. We failed to observe any indication of my transmissions on the cardiac monitor. Both patient-monitoring telemetries and

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When Computers Were Only Dreams ...

You read about them in 73.

While searching through boxes of old magazines, intent on completing my full collection of 73 Magazine *(before it included "Amateur Radio Today"), I found the last three issues I needed: January, February, and March, 1961. A few additional issues from that year made up the package. The ten dollars was well worthwhile, especially since two of the issues contain what may be the first two articles that prophesy the marriage of amateur radio and computers.*

Naturally enough, these articles were not among the missing issues from my collection, but were from the April and September editions. The first dealt with automation, the second with zero-shift keying. The title of each was, respectively, "Automation" and "Zero-Shift Keying" and they were written by the same man. You might think they were written today when personal computers sit on each of our desks, but, no, they were written when computers were still mysterious kludges that occupied climatically controlled rooms of vacuum tube devices and mechanical relays. Let's take a look at the forward thinking of this visionary writer, Jim Kyle K5JKX/6.

The April edition did not feature an April Fool's article. In fact, Wayne's subtitle in the table of contents said, "You didn't think we'd pass up April without *one* feature, did you?" Nineteen articles graced the pages of the 64-page magazine that was based in Brooklyn. Perhaps this was the Fool's article, because so few people had ever heard of a computer that it must have been a joke. But consider this: Jim described in a fictional conversation "a complete circuit for a fully-automated ham station." Although the conversation (and the circuit) were fictitious, the block diagram and description performed the following:

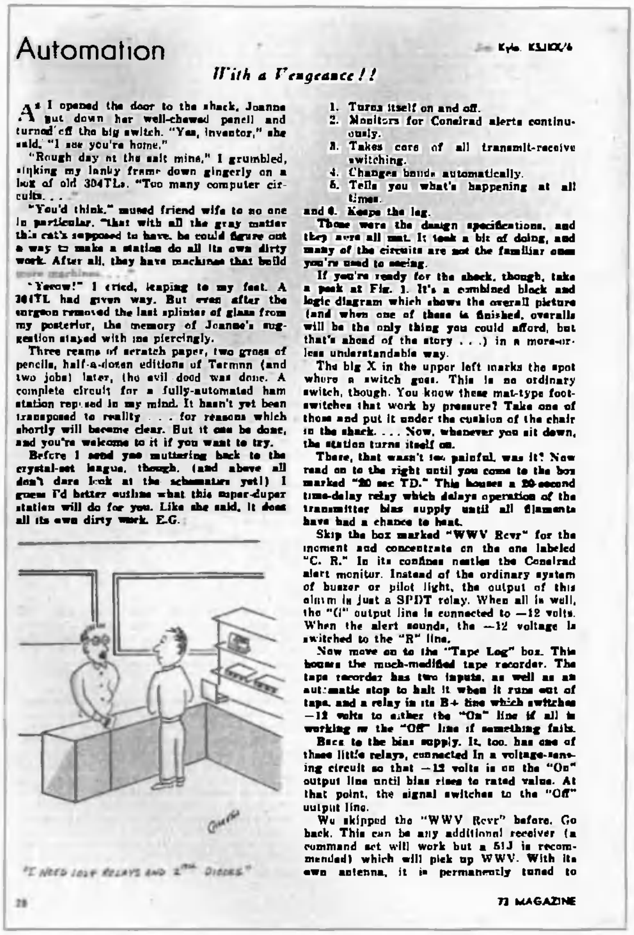
1. Turns itself on and off.
2. Monitors for Conelrad alerts continuously. (Remember, the article was published in 1961, right in the middle of the Cold War!)
3. Takes care of all transmit-receive switching (because hardly anyone had a transceiver; almost everyone used a separate transmitter and receiver).
4. Changes bands automatically.
5. Tells you what's happening at all times.
6. Keeps the log. (Remember logbooks, and the requirement to maintain them?)

The design even called for a simple switch under the chief op's seat cushion that controlled the station's master power switch. Sit down, power on; stand up, power off! Simple. A time-delay circuit controlled the tube bias voltage so transmissions could not begin until the filaments were properly heated. (Vacuum tubes required time to heat up and voltage to stabilize, unlike solid-state devices today.)

A Conelrad receiver controlled a relay which turned off power in case of an air raid alert, but the diagram showed a gate logic device (a symbol for one, actually) which is ORed to the speaker, ORed to the bias supply to disable the transmitter, and ANDed to another receiver and tape recorder to record WWV time signals to time stamp the Civil Defense broadcast. As a fail-safe system, if the tape recorder ran out of tape (this is before the days of tape cassettes), the system similarly would disable the transmitter control.

A flip-flop arrangement is "connected so that when the transmitter is on, no signal can get through to a stepping relay which operates slave relays in each stage of the transmitter." A stepping relay can only change bands when the transmitter is not transmitting and the relay's input gate is ANDed to a push-button on the operator's armchair.

Kyle added additional refinements, such as automatic logging with a WWV time signature recorded along with each word spoken. He recommended stenographic transcription "if the Radio Inspector rules" that such a log would not be acceptable. (In the



Automation

With a Vengeance!!

Jim Kyle, K5JKX/6

As I opened the door to the shack, Joanne put down her well-chewed pencil and turned off the big switch. "Yes, inventor," she said, "I see you're home."

"Rough day at the salt mine," I grumbled, sinking my lanky frame down gingerly on a box of old 304TLs. "Too many computer circuits. . . ."

"You'd think," mused friend wife to no one in particular, "that with all the gray matter this cat's supposed to have, he could figure out a way to make a station do all its own dirty work. After all, they have machines that build more machines. . . ."

"Yeeow!" I cried, leaping to my feet. A 304TL had given way. But even after the surgeon removed the last splinter of glass from my posterior, the memory of Joanne's suggestion stayed with me piercingly.

Three reams of scratch paper, two gross of pencils, half-a-dozen editions of Terman (and two jobs) later, the evil deed was done. A complete circuit for a fully-automated ham station reposed in my mind. It hasn't yet been transposed to reality . . . for reasons which shortly will become clear. But it can be done, and you're welcome to it if you want to try.

Before I send you muttering back to the crystal-set league, though, (and above all don't dare look at the schematics yet!) I guess I'd better outline what this super-duper station will do for you. Like she said, it does all its own dirty work. E.G.

1. Turns itself on and off.
2. Monitors for Conelrad alerts continuously.
3. Takes care of all transmit-receive switching.
4. Changes bands automatically.
5. Tells you what's happening at all times.

and 6. Keeps the log.

Those were the design specifications, and they were all met. It took a bit of doing, and many of the circuits are not the familiar ones you're used to seeing.

If you're ready for the shock, though, take a peek at Fig. 1. It's a combined block and logic diagram which shows the overall picture (and when one of these is finished, overalls will be the only thing you could afford, but that's ahead of the story . . .) in a more-or-less understandable way.

The big X in the upper left marks the spot where a switch goes. This is no ordinary switch, though. You know these mat-type foot-switches that work by pressure? Take one of those and put it under the cushion of the chair in the shack. . . . Now, whenever you sit down, the station turns itself on.

There, that wasn't too painful, was it? Now read on to the right until you come to the box marked "20 sec TD." This houses a 20-second time-delay relay which delays operation of the transmitter bias supply until all filaments have had a chance to heat.

Skip the box marked "WWV Rcvr" for the moment and concentrate on the one labeled "C. R." In its confines nestles the Conelrad alert monitor. Instead of the ordinary system of buzzer or pilot light, the output of this alarm is just a SPDT relay. When all is well, the "G" output line is connected to —12 volts. When the alert sounds, the —12 voltage is switched to the "R" line.

Now move on to the "Tape Log" box. This houses the much-modified tape recorder. The tape recorder has two inputs, as well as an automatic stop to halt it when it runs out of tape, and a relay in its B+ line which switches —12 volts to either the "On" line if all is working or the "Off" line if something fails.

Back to the bias supply. It, too, has one of these little relays, connected in a voltage-sensing circuit so that —12 volts is on the "On" output line until bias rises to rated value. At that point, the signal switches to the "Off" output line.

We skipped the "WWV Rcvr" before. Go back. This can be any additional receiver (a command set will work but a 51J is recommended) which will pick up WWV. With its own antenna, it is permanently tuned to

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An Argument for a New Type of Radio Communication

Zero-Shift Keying

Jim Kyle K5JKX/6

Are you an experimenter, looking for the opportunity to pioneer new fields? Then maybe this article is for you.

Let's admit right off that it's theoretical; although it includes several schematics, none of the equipment has been built or tested—which means that the system may have a number of hidden bugs. However, all the component parts of the system have been used in other branches of electronics with success—and there's no apparent reason why they won't do as well here.

Even if the entire system had been built, it couldn't be tested on the air (except at microwave frequencies, which offer their own problems) under present regulations—which means that if it works for us in our bench test, we'll have to petition the FCC for permission to use this type of modulation on the more-popular ham bands.

But, if it works, getting permission to use it should pose no problem, because the gadget is a high-speed RTTY system requiring virtually zero bandwidth. It's also almost impervious to interference, noise, or other disturbances, and utilizes present equipment with less modification than is necessary with present-day RTTY gear. Only one attachment is necessary at the transmitter, containing a single stage, and another at the receiver.

The entire system is based on the fact that RTTY is basically a binary pulse-code modulation system, in which groups of five pulses convey each letter. Most RTTY activity today uses frequency-shift keying, in which one frequency is transmitted to indicate the presence of a pulse and another frequency is sent to indicate pulse absence. These are known as the "mark" and "space" frequencies.

Commonly, mark and space frequencies are separated by 850 cycles (the value is a carry-over from landline teletype operation) although regulations allow us to use any shift between 0 and 850 cycles.

Now, let's back off a minute and look at the situation from the viewpoint of a digital computer engineer. His hardware operates with strings of binary pulses which are either there or aren't there, too. Instead of mark and space, he calls them "one" and "zero", but it's the same situation. To him, a teletype transmission is simply a chain of 5-bit pulse trains.

One of the larger problems facing computermen today is that of transmitting data from one computer to another cross country, and they've put a lot of study into it. They've analysed almost every possible form of modulation from the standpoint of easy separation of "ones" and "zeroes", and the system we're describing is based on this study.

Take a flow of direct current. Its polarity may be either positive or negative. This provides a binary representation, which in fact has been used in the trans-Atlantic cable.

However, it's difficult to transmit dc over the air, so let's turn our attention to a sine wave. It, also, may be either positive or negative. That is, the sine wave may be either in phase with a known reference, or 180 degrees out of phase with the reference. This, too, provides a binary representation.

In other words, "mark" can be represented by an rf sine wave of any desired frequency and "space" would then be a sine wave of the same frequency but 180 degrees opposed in phase. Since frequency would remain unchanged, bandwidth of the system would approach zero (actually, in FM terms the signal would have infinite bandwidth every time the phase changed and zero bandwidth in between. However, energy content at any one frequency of a signal of finite power spread over an infinite band is infinitesimal and can be ignored).

To accomplish this in an actual transmitter,

Fig. 1

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mid-80s, many repeater trustees tape-recorded *all* conversations to ensure fully accurate logging to meet the then-current logging requirements.) He concluded that "With care, [the system] could be built in a standard six-foot relay-rack cabinet for something less than $1,568." He recommended "judicious selections from surplus." His final statements were more prophetic than he realized: "That's why it's never been built here, and probably won't be in the near future. But if you have a pair of oil wells in the back yard, and don't mind a little tinkering, you too can have a completely automated station. And with a little more engineering, it can be made to operate itself, freeing you from the drudgery of contests and the like and leaving you free to read …"

Here we are, 40 years later, which still might be considered "near future" for Jim's article, and we have met his criteria for an automated station. Not quite computerized, but his article did develop and explain precise logic paths that could be done with the technology of the time, and it was a portent of things to come. The price for the relays and rack that he quoted were pricey in their day, but the cost of the intelligence to fulfill this dream rose while that of the hardware fell. We can

do the six tasks he mentioned for half the price he quoted, and we do not need that relay rack. We also have the luxury of some extra intelligence in our computer logic today to satisfy the dreams mentioned in his second article, a zero-shift keyed signal and detection system.

By September of that same year, 1961, the Johnson Ranger II was announced, along with the Swan single-band transceivers (for only $275). Lafayette Radio introduced the HE-50 10 meter AM transceiver that ran 12 watts input to the final and had both the 117 VAC and 12 VDC power supplies built-in. It used only eight tubes but required crystals for the transmit frequency, unless you had an external VFO. AM was still king, with its broad signal on the band. Jim Kyle wrote an argument for a new type of radio communication, a data transmission medium: zero-shift keying.

He admitted right off that this was theoretical; none of the equipment had been built or tested. He acknowledged that the then-current FCC rules would only allow such a signal on microwave frequencies (for hams) since it was a different modulation type than allowed on other ham bands. He suggested petitioning the FCC if the concept proved feasible. He called this a "gadget," a high-speed RTTY [Radioteletype™] system "requiring virtually no bandwidth ... almost impervious to interference, noise, or other disturbances. Only one attachment is necessary at the transmitter, containing a single stage, and another at the receiver." It almost begins to sound like PSK31.

Beginning with an analysis of the 850 "cycle" shift of a RTTY signal, he moved into a discussion of polarity shifting a DC signal and then to phase modulation of that DC signal. He showed a schematic of such a balanced modulation keying unit that could be inserted just prior to the final amplifier. Keying the SSB signal with a sine wave input, he accomplished phase modulation of a single frequency. One half of the mission accomplished!

Kyle next explored detection, offering a schematic of a phase detector as a comparator of reference and incoming signals. Tapping the final IF's grid and feeding it into the receiving adapter (schematic supplied!) produced a shifting signal similar to rapidly switching sidebands according to the incoming signal. He said, "In addition to the saving in spectrum space ... [and in] the absence of a strong interference which might capture the phase-reference generator, the only requirement for a solid copy would be that the incoming signal be somewhere in the receiver passband. ... This means that the signal can be 3 dB [sic] lower in the noise level for the same accuracy of copy."

How prophetic! Like most prophets, Kyle adds a clarifying note to his diagram description: "This [style of potentiometer and diode arrangement] probably won't affect you, since the likelihood of your building this circuit is rather remote."

Remote, indeed! It took less than 40 years to make both of Jim Kyle's visions practical. Jim was a prolific writer and had several articles each in different editions as *73 Magazine* became established. He had wide talents: he wrote technical license training manuals, editorials about the hobby, visionary articles such as I have cited here, and more. Some people said a long time ago that there was nothing new to invent. We have proven that wrong many times over. However, perhaps there is room to rediscover old dreams so we can make them happen now that we have the technologies required to make them real. Mankind evolved from tool maker to machine maker. Now, we can become the dream makers.

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Gold Is Where You Find It!

My first on-the-air experience.

A lot of jokes have been made about those paragons of industry and virtue, the infamous "brothers-in-law," but after some reflective thought, I now recall that I owe my start and beginning success in amateur radio to not just one but two of those much-maligned persons. Hi!

I am one of many people who almost did not discover amateur radio and, in fact, I did not get my ticket until after I graduated from college in 1951. Up to that time, I had little knowledge of ham radio, and gave little thought to the possibility of getting a license and getting on the air with my own station.

My sister's husband (brother-in-law number 1), who had been a radio operator in the Army Air Corps, came home after attending the Spartan Aeronautical Institute in Tulsa, Oklahoma. As part of his schooling, he had gotten both his amateur radio license (WØKIR) and his commercial radio operator's license. His description of ham radio and what it takes to get on the air made me realize that I, too, could get a license and get on the air. (A special thanks to you, Al.)

Some time after that I was able to get my Novice license by going to Pittsburgh to the FCC office and taking the test. I received the call WN3VXS — which I never made a contact with because I had no transmitter. Three months later, I again went to the FCC office and received my General class ticket, W3VXS — but I was still not on the air because all I had was a home-brew, one-tube regenerative receiver!

An interesting sidelight here is that I have taken all of my exams at FCC offices and, because I have moved around some, I have had six calls (WN3VXS, W3VXS, K2YOJ, K4DCX, W2HFF, and W2UW) in that order.

But back to the story. I was soon on the air, to some extent, with a crystal-controlled 6AG7-1625 kit that I purchased. I made very few contacts due to my inexperience and my poor receiving equipment (the regenerative receiver). However, fortune smiled on me based on that old adage, "Gold is where you find it!"

Enter brother-in-law number 2! While visiting my wife's family, we were all sitting around talking. I opened a conversation with my wife's brother, "Bud."

I said: "Now that I have my amateur radio license, I need to get a better receiver for listening." (Meaning to impress everybody with the idea that I was now a ham radio operator.)

Bud said: "You know, Glenn, I think that I have an old radio that you might be able to use."

I said: "Bud, what I need is a radio with more than one band." (I'm thinking: Oh-oh, he probably doesn't understand ham radio and this is just some old junk BC radio!)

Bud said: "Well, this has more than one band on it. I bought it at a garage sale for 12 bucks to have in the living room to listen to the news. You are welcome to it, if you are interested."

I said: "Well, what I really need is a radio with shortwave bands." (I'm thinking: He is probably talking about a cathedral-type radio with shortwave bands for the shortwave listener.)

Bud said: "Well, this has shortwave bands and I keep it on the end table."

I said: "Well, I need to receive code, and that takes a communications-type receiver with a BFO." (I'm thinking: From his description, it must be a 5-tube AC/DC set with shortwave bands.)

Bud said: "I think this thing receives code, but I haven't tried it much."

(I'm thinking: I better make it clear to him exactly why what he has will be of no use to me!)

I said: "Bud, what I am looking for is a shortwave communications receiver

Continued on page 57

Calendar Events

Listings are free of charge as space permits. Please send us your Calendar Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the December issue, we should receive it by September 30. Provide a clear, concise summary of the essential details about your Calendar Event.

SEP 1

UNIONTOWN, PA The Uniontown ARC will hold its 52nd annual Gabfest at the club grounds located on Old Pittsburgh Rd., just north of the intersection of Rts. 51 and 119. The Gabfest starts at 8 a.m. Free parking and free tailgate space with registration. Talk-in on 147.045(+) and 147.255(+). Table space available. For more info contact Carl *Chuprinko WA3HQK*, or Joyce *Chuprinko KA3CUT*, 84 Heaven Hill Rd., Morgantown WV 26508. *Tel. (304) 594-3779.*

SEP 7, 8

MENA, AR The Queen Wilhelmina Hamfest Association will present their 32nd annual Mena Hamfest on September 7th and 8th at the Queen Wilhelmina State Park near Mena AR. The location is 13 miles west of downtown Mena, on Hwy. 88. Talk-in is on 146.79. 100 Hz tone. For flea market spaces, contact *Charlotte Lee KC5DOR* at *[clee48@ipa.net]*, or *415 Crosstrails Rd., De Queen AR 71832*. The Grand Prize will be a DX70.

SEP 8

BARTONSVILLE, PA The Eastern Pennsylvania ARA and The Pocono ARK will co-sponsor the Pocono Area Hamfest and Electronics Exposition, Saturday, September 8th, at the Monroe County Vo-Tech in Bartonsville. This event will feature new and previously owned equipment, electronics parts, radios, computers, and more. Admission $5. children and spouses free. Gates open at 8 a.m. for the general public. Vendors: $15 inside space 12 ft. x 6 ft. each; $5 outside space 10 ft. x 20 ft. each. Vendor gates open at 6 a.m., with set up *before* 6 a.m. Set up time must be pre-arranged. Talk-in on 147.045(+) PL 131.8, 146.865(-) PL 100, or 146.535 simplex. VE exams will be available. For further details contact *Bill Connelly W3MJ* at *(570) 424-2174;* or *Jerry Truax N3SEI* at *(570) 620-9080.* The theme of this event is "Public Service & Fun for the Whole Family." Various area public service agencies, the National Weather Service, Search and Rescue, Fire Dept., etc., will be on hand, as well as many vendors and exhibitors.

LOUISVILLE, KY The Greater Louisville Hamfest/ARRL Kentucky State Convention will be held at the Bullitt County Fair Grounds, about 15 minutes south of Louisville. Advance tickets $6, $7 at the door. Send an SASE for tickets or info to P.O. Box 34444-N, Louisville KY 40232-4444. Info for commercial spaces is available at (812) 294-4021, or (812) 284-5853. For flea market spaces call *(502) 935-7197* or *(859) 284-9090; fax (859) 284-5296.* The Web site is [http://mx2.confluentasp.com/~glha/].

SPENCER, IN The Owen County ARA and the Bloomington ARC will co-host a hamfest on September 8th. For more info contact Katie Smith K9INU, *tel. (812) 829-2140;* or Millard Quails K9DIY, tel. (812) 332-0074.

SEP 9

BALLSTON SPA, NY The Saratoga County R.A.C.E.S. Assn. Inc. will hold its 16th Annual Hamfest on Saturday, September 9th, at the Saratoga County Fairgrounds in Ballston Spa. This will be held rain or shine, all under cover. Gates open at 7 a.m., with the hamfest running until 3 p.m. Admission is $5, including 1 tailgate spot and free parking. There will be door prizes, a fox hunt, VE exams, and plenty of food. Talk-in on 146.40/147.00 and 147.84/.24. Reserved tables $5 each, first come, first served. Reservations and pre-pay welcome and encouraged. Early set up for all vendors. For further info and/or reservations, contact *Darlene Lake N2XQG, 314 Louden Rd., Box #84, Saratoga Springs NY 12866;* tel. *(518) 587-2385*, E-mail *[lake@capital.net]*.

BETHPAGE, NY The LIMARC Fall 2001 Electronics Hamfair and Flea Market will be held Sunday, September 9th, at Briarcliffe College, 1055 Stewart Ave., Bethpage NY. Gates open at 7 a.m. for vendors, and at 8:30 a.m. for buyers. Outdoor tailgating only, rain or shine. Each space is $15 and includes admission for one person. Additional workers will be $6 each. No advanced registration needed. General admission is $6, children 12 and under accompanied by a paying parent, as well as non-ham sweethearts, are free. For more info visit the LIMARC Web site at *[http://www.limarc.org]*, or call the 24-hour hotline at *(516) 520-9311*. Talk-in is on the 146.850 rptr., PL 136.5. E-mail *[hamfest@limarc.org]*.

SOUTH DARTMOUTH, MA The Southeastern Massachusetts ARA, Inc., will hold its annual flea market on the club's grounds at 54 Donald St., South Dartmouth MA. The event will run from 9 a.m.–1 p.m. Talk-in on 147.00/.60. Admission $2, spouse and children free. Food, door prizes, walk-in VE exams (10 a.m.), and more. Free space for vendors! For further info contact *Tim Smith N1TI* at *(508) 758-3680;* or by E-mail at *[rt_smith@yahoo.com]*.

SEP 14, 15, 16

PEORIA, IL The Peoria Area ARC will host the Peoria Superfest 2001 Amateur Radio, Computer and Electronics Show at Exposition Gardens, Peoria IL. This has also been designated as the 2001 ARRL State of Illinois Convention. ARRL Illinois Section Manager Bruce Boston KD9UL will attend, and Mike Nowack NA9Q will provide an ARRL DXCC card check. The flea market will be held 3 p.m. until dark on Friday, September 14th. Live music will be presented Saturday night in the South Garden Pavilion. VE exams will take place Sunday, 10 a.m.–1 p.m. Gates open 3 p.m. Friday, 6 a.m. Saturday and Sunday. Commercial buildings will be open Saturday, 8 a.m.–4:30 p.m., and Sunday, 8 a.m.–3 p.m. Advance tickets are $5 with two stubs; $7 at the gate with one stub. All tickets good for the weekend. Outdoor flea market space can be reserved in advance for $5, plus $5 for each admission ticket. Space and admission tickets are good for the entire weekend. Set up for the outdoor flea market will be Friday at 10 a.m.; 6 a.m. Saturday and Sunday. Set up for indoor commercial vendors will be Friday, 2 p.m.-9 p.m.; Saturday, 6:30 a.m.; Sunday, 7:30 a.m. Talk-in on 147.075(+). Visit the Web site for the latest Superfest info *[www.w9uvi.org]*. E-mail for tickets and space reservations to *[w9uvi@arrl.net]*. The postal mail address is *Peoria Superfest, P.O. Box 3508, Peoria IL 61612-3508.*

SEP 16

NEWTOWN, CT The Western CT Hamfest will be held at the Edmond Town Hall, Rt. 6, 9 a.m.–2 p.m. Set up is at 7 a.m. Exit 10 on I-84.. Talk-in on 146.67/.07. PL 100.00. New equipment dealers, flea market, tailgating, computers, refreshments. Tables are $10 each including admission, tailgating $6 including admission. Admission $4, under 12 free. For reservations and info contact Ken Weith KD1DD, 8a Hoyt Rd., Bethel CT 06801. Tel. (203) 743-9181.

SEP 22

BENTONVILLE, AR The BCRO Hamfest will be held September 22nd from 8 a.m.–1 p.m. at the National Guard Armory in Bentonville AR. Contact Shirley at (501) 451-8626; or Betty at (417) 435-2332.

NEW PORT RICHEY, FL The Suncoast ARC will hold the 11th Pasco County Hamfest 9 a.m.–3 p.m. on September 22nd, at the New Port Richey Rec. Center, 6630 Van Buren Rd., New Port Richey FL. Admission $5, XYLs and under 12 free. Tables $15 each, electric $5. Tailgate spaces $3 each. You must have admission to enter tailgate or exhibit hall. This event will be held inside with air conditioning. For more info, contact *Owen Godwin KI4CT, (813) 909-1336;* E-mail *[KI4CT@ARRL.NET].* Talk-in on 145.35 rptr.

SANTA ROSA, CA The Sonoma County Radio Amateurs, Inc. annual Hamfest and VE session will be held September 22nd at Lewis Adult Education Center, comer of Lewis Rd. and Lomitas Ave. in Santa Rosa CA. Vendors enter at 6:30 a.m., buyers at 7:30 a.m. Double parking spaces for vendors at $10 each; buyers free. Food available. VE exams 9 a.m. –12 Noon. For more info call *Rick K6ZWB* at *(707) 575-4455,* or go to the Web site at *[http://www.cds1.net/scra].* Write to *SCRA, P.O. Box 116, Santa Rosa CA 95404.*

SEP 29

HORSEHEADS, NY The Amateur Radio Association of the Southern Tier presents its 26th Annual Elmira International Hamfest-Computerfest on Saturday, September 29th, at the Chemung County Fairgrounds in Horseheads NY. Talk-in will be on 146.700(-), with an alternate frequency of 147.360(+) (in case the primary frequency is down). There will be dealer displays of new equipment, and a large flea market area. Breakfast and lunch will be served on the premises. Admission is $5 in advance and $6 at the gate. The event will run from 6 a.m.–3 p.m., with VE exams starting at 9 a.m. For info about VE exams, contact John at (607) 565-4020. For tickets and dealer info contact Randy at (607) 738-6857. The Web site is at [http://www.arast.org].

OCT 6

HOLTON, KS The Atchison County (Kansas) ARC will host their 1st Annual Northeast Kansas Ham Radio Swapmeet at Jackson County Fairgrounds, intersection of US-75 and K-16 in Holton KS. This is 1/2 hour north of Topeka. Talk-in on 146.775 (-600), and 146.52 simplex. Gates open at 6 a.m. Admission is $1. Tailgating $1 with one admission; under cover $3 with one admission. Some electric outlets are available. Bring your own tables, etc. For info and advance registration, call Joel K1CQ at (785) 945-3763, E-mail [k1cq@arrl.net]; Darrel KCØEYU, (785) 442-3572; or Jim KØYLW, (785) 364-3989. You can E-mail Jim at [kØylw@yahoo.com].

OCT 7

MEDINA, OH The Medina Two-Meter Group will host the 2001 Medina County Hamfest at the Medina County National Guard Armory, 920 W. Lafayette Rd., 1/2 mile west of the fairgrounds. Vendor set up at 6:30 a.m. Advance tickets $4 each.Tables $9 each, includes one admission ticket per table. Open to the public 8 a.m.–2 p.m. For info about VE exams, please call Fred at (440) 236-3477. Walk-ins always welcome. Testing starts at 9 a.m. For general table info contact *Mike N8TZY* at *(330) 273-1519.* Please send your remittance, with an SASE, to the Medina Hamfest Committee, P.O. Box 452, Medina OH 44258. Advance reservations must be received by September 29th to guarantee space. All tables will be held until 9 a.m. on the day of the hamfest. If you have any special needs or requests, please let M2M know and they will try their best to help.

WALLINGFORD, CT The 9th Annual Nutmeg Hamfest & Computer Show and ARRL Connecticut State Convention will be held October 7th, 9 a.m.–3 p.m. at the Mountainside Special Event Facility located off Exit 15, I-91 in Wallingford CT. Follow signs. Talk-in on 147.36. Inside selling spaces $30 (booth space with 8 ft. table and chair). Outside spaces $20 for a 30 ft. space. If you reserve and pay in full before September 1st, deduct $5. Major vendors will be attending. General admission is $7, children under 12 $3. Sellers, contact Mark Mokoski WA1ZEK at (860) 808-1275 regarding discounts available for payments received before September 1st. Make checks payable to Nutmeg Hamfest, and send to Mark Mokoski WA1ZEK, 944 Killingworth Rd., Higganum CT 06441. For info regarding VE exams, contact *Joel Curneal N1JEO, (203) 235-6932.* Be sure to take a look at the Web site at [www.qsl.net/nutmeghamfest]. E-mail to [nutmeghamfest@qsl.net].

OCT 21

QUEENS, NY The Hall of Science ARC Hamfest will be held at the New York Hall of Science parking lot, Flushing Meadow Corona Park, 47-01 111th St., Queens NY. Doors open for vendors to set up at 7:30 a.m. Buyers admitted at 9 a.m. Free parking. VE exams at 10 a.m. Admission by donation, buyers $5, sellers $10 per space. Talk-in on 444.200 rptr., PL 136.5, and 146.52 simplex. For further info, call at night only, Step*hen Greenbaum WB2KDG (718) 898-5599, E-mail [WB2KDG@Bigfoot.com].* For VE info only, contact Lenny Menna W2LJM, (718) 323-3464, E-mail [LMenna6568@aol.com].

Continued on page 57

Amateur Radio Via Satellites

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Field Day 2001

Field Day is one of the most popular on-the-air contests/activities in amateur radio. It is held each year on the fourth weekend in June. The event is sponsored by the American Radio Relay League (ARRL) as an emergency preparedness exercise. During the 24-hour period, U.S. and Canadian participants strive to make as many contacts as possible operating in remote locations from tents, campers, vehicles, or just a simple set up in the middle of a field.

The ARRL Field Day rules consider the amateur satellites as a separate band and provide a 100-point bonus for the first satellite contact. The Radio Amateur Satellite Corporation (AMSAT) version of the event considers each satellite as a separate band, encourages international participation and has additional rules for digital communications. Many Field Day groups have made efforts to put more emphasis on their satellite stations, both for ARRL points, and to simultaneously make contacts in the AMSAT competition.

Field Day 2001 via satellite

Last year AMSAT-OSCAR-10 was surprisingly good. This year however, AO-10 was only a solid performer toward the end of the operating period. This 18-year-old hamsat can be quite unpredictable since the onboard computer gave out over a decade ago. When AO-10 was nearing perigee (the low point of its elliptical orbit) many voice and CW contacts were made. Even with the problems, AO-10 is still a great resource in the sky. It is simply an uncontrolled, but functional Mode "B" (70 cm up and two meters down) transponder in space.

The Fuji satellites, F-O-20 and F-O-29, were both in analog (SSB and CW) mode for Field Day. Contacts were plentiful for those that were prepared for the exceptional Doppler shift associated with these hamsats 70-cm downlink. The signals can drift as much as 20 kHz in the course of an overhead pass. Satellite newcomers had problems keeping up.

The Russian RS-12/13 hamsat did well. The satellite is currently in Mode A using the RS-12 hardware. This means that its analog transponder receives on two meters and downlinks on 10 meters. Last year RS-12/13 was using the RS-13 system and was also receiving on the Mode K, 15-meter receiver, in addition to the two-meter receiver (Mode K + Mode A = Mode KA). Due to the great band conditions on 15 meters, numerous stations that were simply working terrestrial 15-meter Field Day, were heard through the transponder. While this was entertaining, it made it very hard to tell the difference between satellite stations and those that were inadvertently being heard through the satellite. Operation in the 2001 event was easier since the only signals in the 10-meter downlink passband were uplinked intentionally for RS-12 retransmission via the two-meter satellite receiver. Many operators found RS-12 to be less crowded and easier to use than the Fuji hamsats, but without many operators on CW, just voice. There have been no reports of any successful RS-15 contacts during Field Day 2001.

Operation via AMSAT-OSCAR-27 and

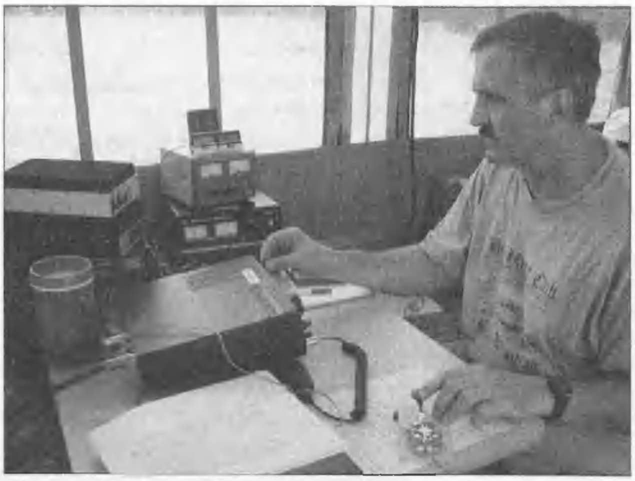

Photo A. Doug WB5TKI makes another satellite contact from K5ENG in South Texas during Field Day 2001. (WA5TWT photo)

Photo B. An air-conditioned camper kept things cool at K5ENG in South Texas. (WA5TWT photo)

Photo C. Breck K4CHE and Mike WB3ILM at W3HZW used a home-brew dual-band yagi, an Icom IC-821H and a battery for their contacts via FO-29 during Field Day 2001 from Delaware. (K4CHE photo)

Photo D. William PE1RAH and Dirk ON1DLL at ON5LL ran separate digital and analog stations with batteries, solar cells and backpack radios from northeast Belgium. (ON1DLL photo)

UoSAT-OSCAR-14 was once again, as expected, super crowded! These single-channel FM Mode "J" (2 meters up and 70 cm down) repeaters in the sky were working well even though it sounded like hundreds of stations were trying to access the satellite simultaneously. The result is that only a few contacts are made, usually by the stations with the biggest antennas and the strongest transmitters. It was wild, but at least it was only temporary. Unfortunately there were a number of stations trying to get their 100-point ARRL Field Day bonus using HTs and small beams. Most were disappointed, but changes in the AMSAT rules made it possible for at least a few more stations to make contacts with something less than monster antenna arrays and high-power two-meter amplifiers. The modified rules specify that each station is allowed credit for only one contact per FM satellite during Field Day. Participants were encouraged to make their single contact and move on to other hamsats for the duration. Some exceptions were heard, but the really "big guns" followed the recommended procedure, made their one contact, and left.

The digital hamsats were a disappointment. UoSAT-OSCAR-22 was the only active 9600-baud satellite. For the duration of the event stations did their best to upload a Field Day greeting message and download as many as possible. While KITSAT-OSCAR-23 and KITSAT-OSCAR-25 were available last year, KO-23 is considered out of commission due to battery problems, and KO-25 isn't doing much better. Rule changes put in place for Field Day 2000 also allowed digital contacts that use the amateur-radio satellites as flying digipeaters. UO-22 supports this mode in addition to its BBS-style system.

Photo E. Checking the antennas at ON5LL for Field Day 2001 — AMSAT rules. (ON1DLL photo)

Where was AO-40?

Prior to Field Day there was some hope that our newest hamsat would be available for Field Day 2001, but with orientation maneuvers underway, it was not likely. Control stations spent the early weeks of June positioning AMSAT-OSCAR-40 for ammonia arcjet motor firing. During Field Day telemetry was being downloaded and studied to determine the effectiveness of the ATOS (Arcjet Thruster on OSCAR Satellite). This motor was originally designed to expel ammonia gas past an arc created by a spark plug. While the thrust would be low, it would be sufficient for minor long-term orbital modifications. More information about the ATOS system can be found at: [http://www.irs.uni- stuttgart.de/RESEARCH/EL_PROP/PROJ/e_atos.html].

Just before Field Day the ATOS motor was activated for one hour near apogee (the high point of the orbit) without the spark plug. The result was an apparent 2.5 km change in the perigee from 279 km to 282 km. A large number of firings were anticipated to use up the 53 kg of ammonia onboard the satellite and raise the perigee further.

One week after Field Day an announcement from AMSAT-DL President Peter Guelzow DB2OS stated that all of the ammonia had been used and a final perigee height of 851 km had been achieved. While there can be no further modifications to AO-40's orbit, the good news is that AO-40 has a much higher (stable) perigee, and it's time for transponder schedules and more communications experimentation.

An unexpected surprise

Although contacts with the International Space Station were not counted for AMSAT Field Day operations in 2001, that didn't stop a good number of International Space Station (ISS) enthusiasts from plotting orbits and listening on the 145.800 MHz FM downlink frequency. They were not disappointed. Susan Helms was operating Field

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Radio Direction Finding

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Texas Teens Track Transmitters and Talk Tech

Wireless! It used to be an antiquated term for communications through the ether, back in the days of spark transmitters and coherer receivers. Nowadays, it's been given an entirely new meaning and importance.

Today's wireless world encompasses a myriad of new techniques and products for connecting individuals and businesses nearly anywhere on earth. Predictions for its future are nothing short of phenomenal. One source estimates 210% growth in cell/PCS phones and 1500% growth in Internet-enabled phones in the next three years. After that, who can guess?

What does this have to do with radio direction finding (RDF) and hams? To answer that, consider another question: Where will the designers of the next generation of wireless devices come from? Schools are churning out computer and networking engineers, but outstanding RF engineers have been much harder to find.

According to Ellen Gaconnier, a manager at Nortel Networks, there are 300,000 job openings in the telecommunications market, and in five years there will be 1.5 million such openings in the USA. She says that the reason for the coming shortfall is that students are not taking the math, science, and technology classes necessary to enter these fields.

Just as young people are needed for the future of ham radio, our hobby can be beneficial to youth, by introducing them to the importance of wireless technology and the opportunities for careers in this wide-open field. Last month, I told you how a pair of California hams are using RDF to bring kids, amateur radio, and wireless technology together. This month we'll meet two Texas hams who are taking a somewhat different, but equally effective, approach.

Foxhunting Fun at Tech Camp

Jeff Fant N5OLF (**Photo A**) of McKinney, Texas, is a Professor of Engineering Technology at Collin County Community College (CCCC). One of his specialties is telecommunications and computer networking. "I started the Cisco academy here," he says. "Now it's the largest in the nation. I looked around and saw a lot of older people coming into our program, but I didn't see many high school graduates. Where were the kids?

"I realized that I had to get to them before high school," he continues, "before they get their hormones going and get cars. I got a Carl Perkins grant to get a bunch of equipment in my hands so I could go into the elementary, middle, and high schools. Now we do a bunch of presentations with ham gear every year."

N5OLF's presentations are part of CCCC's Technology Awareness Program (TAP). "I take a computer and projector with me to show some satellite tracking. We talk about communicating through the satellites. We also make phone patches and send slow-scan video back and forth with those little Kenwoods. The elementary school kids go

Photo A. Jeff Fant N5OLF helps Tech Camp students learn to solder. Safety goggles are mandatory. (All photos courtesy of Collin County Community College.)

Photo B. Campers are getting acquainted with the directivity of their Arrow yagis. At far left is Tom Mobley KD5AC.

Photo C. A variation on the foxhunting theme is to have students be the foxes. What a great way to play hide-and-seek!

Photo D. KD5AC made miniature UHF fox transmitters for Tech Camp. They could be anywhere in the tall grass behind these youthful foxhunters.

nuts when I tell them, 'You can do this!' I tell them that the youngest amateur was five years old and there's no age limit."

Jeff's next step was to organize a club for kids called Sigma Gamma Epsilon. Those Greek letters stand for SGE, or Student Game Enthusiasts. As a result of his talks, SGE chapters have since formed at many middle schools throughout the area. At SGE meetings, students learn about ham radio technologies, including packet, PSK31, voice repeaters, and transmitter hunting.

Soon, Jeff discovered that many 6th and 7th graders have an insatiable appetite for technology. He says, "They're the ones asking Mom and Dad, 'What does reciprocity mean?' They want to go further. That led to the first Tech Camp."

"Imagine a camp that takes your children away from isolated Net surfing, and video and computer games, and into team-oriented high-tech games that fit right in with the math and science that they are learning in school. And imagine your children having fun." That's an excerpt from a promotional piece to parents for Tech Camp 2001. It goes on to say that the camp "offers students the best of both worlds: fun activities with high-tech toys and a way to apply math and science skills in meaningful real-life applications."

A key activity at Tech Camp is hidden transmitter hunting, which we hams call foxhunting, foxtailing, radio-orienteering, and ARDF. "Before we start foxhunting, we teach them all about yagis," N5OLF says. "On the second day after they learn about measurements, we make them go outside and lay out on the ground an 80-meter yagi. You need a huge field for that!

"When we come back in, we talk about wavelength and then we flip it around and say, 'What if the frequency is 440 MHz, how big would that be?' They calculate that and then we give them the bags with little Arrow 440 MHz yagi antennas. They get to assemble them and measure them and after that, they go out and see how directional they are (**Photo B**).

"By the end of the week, they're designing their own yagis. They build them with fiberboard that we get from Home Depot and copper tape that you can buy at a tinning place where they make lead windows. The kids get a coaxial cable with BNC connector, a little ferrite bead balun, a couple of tie-wraps and a precut board. They lay down the copper tape to make a yagi, then they hook it to a network analyzer to check it out. We show them how to make their measurements and tune it with a straightedge."

After the Tech Camp students have learned all about directional antennas, it's time for hidden transmitter hunting. The transmitters are very small and put out only a few milliwatts, so extreme attenuation is never needed. "We use the 440 MHz band to keep antenna size down," Jeff explains. "We have a big open area on campus, but they mow it a lot, so we like to be able to put some fox transmitters in the trees and some in the grass.

"The attenuators are passive and do up to about 110 dB. We keep them at the college to use from year to year. We disable the transmitters on the students' hunt radios and we explain attenuators to them, what they're for, how they're used, and why never to transmit through them.

"The first hunts are very simple (**Photo C**), but by the time we get to the end of camp, we have five foxes out there at one

Photo E. Tech Camp students use an Arrow dual-band beam to try for contacts on a ham satellite.

time and they're all unattended (**Photo D**). We put different callsigns on each one and make the students identify them as they find them. The first year, some of them were out in real tall grass. The biting bugs were pretty bad because of the recent rain.

"Some kids found the foxes but they couldn't figure out which ones were which because they hadn't learned CW. We don't give points unless they can identify the foxes, and the others thought it was pretty funny. It was hilarious to watch and a real incentive to get them studying.

"At the end of the first Tech Camp was the big ham convention in Arlington, about 90 miles away. We put a 1.2 GHz antenna on our roof and hit an ATV repeater downtown. From there we connected all the way out to Arlington to the Convention Center. We interviewed everybody, including the keynote speaker and ARRL President Jim Haynie. The kids set it all up, by then some were licensed so they were the control operators. Later, the kids went out to shoot some satellites (**Photo E**). We invited the parents in that day and they were just amazed.

"After we showed them how to find foxes with a directional antenna, we talked about the FCC's new E911 requirements, how you need to be able to determine the location of any cell phone. A lot of the cell sites don't have directional beams, they just have omni antennas. How do you do that? I told them to come back next year, because we're going to find a downed astronaut with just omnidirectional antennas. You have to have teamwork and know all about signal strength. We'll draw sensitivity circles and ... well, you'll just have to come back and see."

Not Free, But Worth Every Dollar

Tech Camp is for students entering the 7th through 9th grades. It costs them $250 each. "A teacher must recommend them and they have to write a 50-word essay on why they should come," says Jeff. "Each camp runs ten days in June, with sessions from 0830 to 1630 hours. They bring their own lunches and a lot of them car-pool together."

TAP gets support from the college and the National Science Foundation, but Tech Camp depends on corporate sponsors for money to buy radio gear for successful campers. Upon getting their first ham ticket, registered students get a Kenwood TH-D7A handie-talkie for voice and packet on the 146 and 440 MHz bands. Upon earning a General Class ticket at Phase II camp, each gets a Ten-Tec QRP transceiver kit.

"We're sitting in Telecomm Corridor, with plenty of high-tech companies here," Jeff says. "I go out every year and make presentations to them. I show them that there's a phenomenal shortage of engineers and competent techs. They're usually aware of that, of course, that part isn't anything new. Then I tell them what we're doing with Tech Camp.

"I explain that if we make learning fun at camp, then kids will go back to the classrooms and enjoy what they're learning. Right now they're being overloaded in school, getting told to 'Just do another 50 problems.' They say, 'When are we going to use this?' and there's just no answer. If they can have fun with it, it gives a whole new meaning to them. Our goal is to help the schools, and if we can get kids excited about technology by doing ham radio, there's no doubt in my mind that their math, science and reading comprehension are going to rise.

"We've done real well with corporations," N5OLF continues proudly. "The first year I showed this to the top people at Nortel and they bought it in five minutes. They wanted to do the whole thing and wrote a check for $34,000. They're having layoffs this year and couldn't throw money at the program, but Ericsson came on board and gave $45,000. We also got smaller donations from some other organizations. Next year, it looks like its going to be Alcatel or Cisco.

Walt Evanyk, a business development manager of corporate strategy and solutions at Ericsson, believes that his company's sponsorship of Tech Camp will help develop future employees. "Standard education curricula do not make these children aware of career opportunities in technology that they can really touch and feel," he says. "So often they say, 'What is telecommunication? Why would I want to work for a phone company?' By encountering technology and applying it to problems or needs, students see how the things that they are learning in school, like math and science, apply to careers."

Corporate sponsorship is very important to Tech Camp, because many educational grants will pay for administrative expenses, but not parts and equipment. "I want to seed the community with technology," says Jeff. "It's one thing to have a kid learn all about ham radio and pass the FCC test, and it's another thing to pass the exam and have some equipment to use. I want them to walk away with some very good gear, so we award them a new HT when they pass. It really has made a difference. They get on voice and packet, and become truly active in the hobby.

"After getting his ticket, one of the students joined Skywarn and has already won some awards for his work. The Plano Amateur Radio Klub is giving their 440 MHz repeater over to the students' use. They're getting ready to move it to the campus. For now, the kids use the McKinney repeater. We're also trying to set up some interactive experiments between the SGE chapters on the air."

Knowing the problems of getting the word out to kids and parents, I asked Jeff how Tech Camp is advertised. "We have had problems going through the school district," he replied. "The approval cycle is just horrendous. There's always people in the schools who are delighted to work with you, but then they have to get approvals from these other people and deal with a lot of red tape. You give it to them three months early and then there's layers and layers that have to sign off on it. What worked better was to take our flyers to places like Blockbusters. We ask to put a flyer on the door and leave some at the checkout. Kids and parents pick them up left and right."

No Cast of Thousands

Jeff's main helper is Tom Mobley KD5AC, another CCCC Professor of Engineering Technology. "He's a character," says Jeff. "He recently graduated and is really sharp. I do most of the presentations and he handles the circuitry. He's a detail person. He makes the transmitters work, so we can stick them down in a culvert or in the grass with a couple of inches of antenna."

"The games we've developed are fun in and of themselves," Tom explains. "They appeal to the whole kid, with a mental aspect of learning to be competitive, a physical aspect of being active in competition, and a social aspect of working in teams."

"It's just the two of us right now," says N5OLF. "We've got a few other guys on board who have realized that this is an important thing to do, but it's going to take some time for them to get loose from other things they're doing and get up to speed. It's almost a full time job to keep this rolling. I have a 5-year plan. Every year we'll add a new game or activity."

Some kids don't know anything about radio before they came to Tech Camp, while others have already been active in SGE. They come from public schools, private schools, and home schooling. Tech Camp 2000 had 57 graduates, 37 of whom obtained FCC licenses. Thirty-four students registered for Tech Camp in 2001. For some, this was their second year. At the end, thirty had ham tickets, 12 of them had passed their CW tests and five were Extras. One student attended both Tech Camps and went from zero to Extra during the two sessions.

"We have one ninth grader who heard about Tech Camp, got registered, and immediately started studying," says N5OLF. "He had his Technician by the start of Camp, then got his General during Camp. He convinced the college to let him take some courses and he's at the top of his class. The professor stopped me in the hall and said, 'Jeff, I gotta talk to you. I have one of your Tech Camp kids and my problem is that I can't challenge him enough. If I do, I lose the rest of the class, and the problem is that the rest of the students are all adults!' This kid wasn't heading down the engineering path at all before, and now all he wants to read is engineering and math books.

"Tech Camp is really different from my college classes. In college, I'm usually dealing with grown-ups. Adults know where

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Mobile, Portable and Emergency Operation

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The Right Tool

There's an old saying attributed to the Chinese that "If all you have is a hammer, every problem looks like a nail." Sometimes in ham radio we may fall into that same trap. Instead of looking at the tool first, let's examine some parts of the hobby and discuss which tool should be chosen to address the problem. Since this column focuses on portable, mobile, and emergency communications, let's limit our discussion to those three very broad but also important categories.

Portable Communications: What are the problems we face in portable operations and how can we solve them? Portable operations often call for a small radio and a convenient antenna. Often it is necessary to provide power without being able to count on commercial power. Either there may not be a handy 110-volt outlet or carrying a 25-pound power supply might be inconvenient. While there's nothing easier than tossing the two-meter handie-talkie into the suitcase, it may not be the only tool. A VHF transceiver and a current repeater directory will help strike up a conversation when operating away from the home QTH but by its nature you will probably find yourself talking to someone within a twenty- or thirty-mile radius of the repeater. What about trying a little portable DX chasing. There are some very exciting new rigs appearing on the market that provide full coverage of the HF spectrum in an extremely modest package. You may be able to power your rig from a gel cell or even a handful of D cells. On the other hand, you don't necessarily need the latest off-the-shelf equipment to operate portable HF. One of the reasons for the continuing popularity of Morse Code is that it is the best mode for operating a small, inexpensive and low power station. Many CW transmitters have been built in the popular "Altoid®" mint boxes. If you've either lost the interest in code, or never gotten bitten by the bug, here's one reason to maybe give it another chance or learn to use the code. If you decide to operate HF, you may want to concentrate on the 10- through 20-meter bands. These are usually open during the day, with 20 meters having the best evening characteristics. At these frequencies you can throw up a portable dipole antenna easily and roll it back up when you're through.

Mobile Communications

While mobile communications often provide a stable platform for a larger rig, and there is a ready 12-volt power supply, the antenna is often a consideration. A larger more effective antenna may present a problem getting the vehicle into a garage or parking deck. While the trusty two-meter is once again the most common band utilized in most areas there is a fair amount of activity on 440 MHz. Besides the normal FM voice communications, APRS is becoming more popular every day with many mobile stations using GPS to transmit their location. Six meters is gaining popularity with more repeaters appearing and 10-meter FM allows one to access a repeater and work the world. Don't underestimate the ability to work HF from a mobile station. I've worked more exotic locations from the car than from the home QTH. Naturally, when we think "mobile" most of us think of cars, but there are similar prospects if you have the opportunity to work as an aeronautical or maritime mobile. Don't forget that any transmissions from a plane or ship require the approval of the pilot in command or ship's master.

Emergency Communications

Of course emergencies bring out the need to provide a wide range of communications. Here the entire tool kit is necessary. We need portability and reliability and the information we may be called upon to handle is quite varied. Naturally VHF and UHF are among the most common tools. APRS is invaluable for storm tracking since it automatically indicates location. Many APRS stations are equipped with weather stations that report temperature, wind speed and direction, barometric pressure and rainfall. The weather service uses these for additional data when making predictions. In areas affected by hurricanes, it is common to track the hurricane's path right on the APRS screen for all stations to monitor. Packet, PACTOR, AMTOR and RTTY provide a means for passing disaster information that cannot be readily intercepted and decoded. This can prove useful for information that may identify individuals affected by the disaster. Amateur radio is, by regulation, prohibited from using codes or ciphers, but there is nothing to deter using a mode that provides a greater measure of security. These modes also are better for guaranteeing accurate copy of the message since many provide an error correction scheme.

Amateur television, both slow scan and fast scan, is also gaining popularity. If a picture is worth a thousand words, imagine how valuable a TV image is to the officials trying to manage an emergency. While commercial television stations may be on the scene, they are interested in shots of areas that will interest their viewers while public officials might need to see less interesting but more important details.

The trick, in my mind is to objectively evaluate what amateur radio modes can do and how it will support a certain goal or solve a particular problem. CW can get through when almost no other mode can. Digital communications are more secure. Voice communications can provide a lot of information to all stations on the network with a single transmission yet can also accept a reply. Different frequencies are best suited for different times of the day. As hams we have an extensive toolkit from which to

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WinLink 2000 and the Airmail Package

If you have suffered the inconvenience of exchanging E-mail while on the road, in your RV or on your boat, this month's reading exercise may show you just what you need. This is not absolutely new stuff. The WinLink 2000 system has been around for a few years, is in a constant state of upgrade and has attracted over 3,000 users.

You will need a computer you can carry with you, an HF rig and a multimode controller. This may be the reason you hung onto that dust collector after the advent of the soundcard programs. The WinLink 2000 network runs on PACTOR and there is as yet, no soundcard software written that will do the job for this application. Hence, the need for the controller. PACTOR is an error-correcting robust mode that suits this service to a "Tee."

One of the really impressive parts of this operation is the great free software available for download to get you started on this project. You can download the latest version of the Airmail package from the listing in The Chart. That's right — here is another freebie put together for the benefit of the ham community.

I think the first thing that surprised me was how easily I was able to set up the software in my laptop and get it to talk to my PK-232MBX. First try, just follow the directions. Also, it doesn't require a super-duper high-speed laptop. Mine has only a 120 MHz CPU with 8Mb RAM and it works like a champ.

Airmail will work with Windows95, 98, ME, NT or 2000 Professional. I will have to admit to some difficulty as I progressed with the review and that centered on the PK-232MBX. It took a bit to identify because the 232 functions great in PACTOR for everyday QSOs but I was having problems with file transfers. There is an advisory note that this controller suffers from RFI on occasion. I did what I could to reduce that, but it wasn't enough, then I received some advice from Steve K4CJX.

He explained that the WinLink 2000 files are uploaded and received in compressed binary format and that to do this the PK-232MBX is a bit overtaxed. The solution is provided in the use of the SCS controllers which are equipped with microprocessors to facilitate the process. The system also supports the Kantronics multi-mode controller, but I have no report on that one except I read no negatives on it.

The only concern I had at first was finding a station to connect to so I could see it work. I listened intently for 15 or 20 minutes and found a station that was handling the desired traffic. The software automatically comes up in PListen mode so you can copy the traffic without being connected.

Once I had found and identified a station, I hit the "Send" button on the monitor and the software asked for a callsign to connect to. I entered that and was on my way to a new adventure. There was still plenty to learn, but I was sure this was something I could do that would put me in touch with both hams and nonhams while on the road.

After getting past what I had been sure was the hard part, it was time to settle in on the specifics of how to send and receive E-mail. Being in a little bit of a hurry (spelled over-anxious), I got the cart just a tad ahead of the horse and found the automated system was particular how I addressed my first message to myself.

That wasn't terribly difficult. Where I had gone wrong was I had done too many things at once and didn't understand how the software recognizes the station you are linked to and sends only messages that are designated to be sent through that station. That is unless, as I was later to learn, I put a wild card named "ANY" in the "via" box to designate any station in the system. Sounds simple enough in hind sight, but for me, it is a long road to where I can look over my shoulder at the marvels revealed by hind sight.

The reason for the confusion was I wanted to control the process. Well folks, this software is written with us dummies in mind. It is fully automated. Once you make the link with the station in the network, the rest is out of your hands. You don't have to tell the system a darn thing.

So it is nearly foolproof. Just don't fight it as I did, and it is about as easy as it can get. After you have made the connection, the software checks to see if you have any mail, requests and accepts a download of waiting messages, and looks at your "posted" outgoing messages and uploads them to the network. After that it is simply an automated disconnect. You do get to watch the process on your monitor. There is just no keyboarding. That is you do not actively give any commands to the network.

The network, within a short time, sends your message through a gateway to the Internet mail system and your message is delivered to the E-mail box for your recipient to accept and read. Then he can send a reply to you even if he is a nonham.

Finding that first WinLink 2000 station

You will find the greatest help in finding a station to connect to will come after a little patient listening. The Airmail software comes with a pull-down list of callsigns and frequencies for each station. This seems to go out-of-date frequently so there are callsign/frequency downloads available with weekly updates to keep your list updated.

However, at first you will need to find that first station. My first and most often readily-connected-to stations were about 1,500 miles away in Texas as propagation

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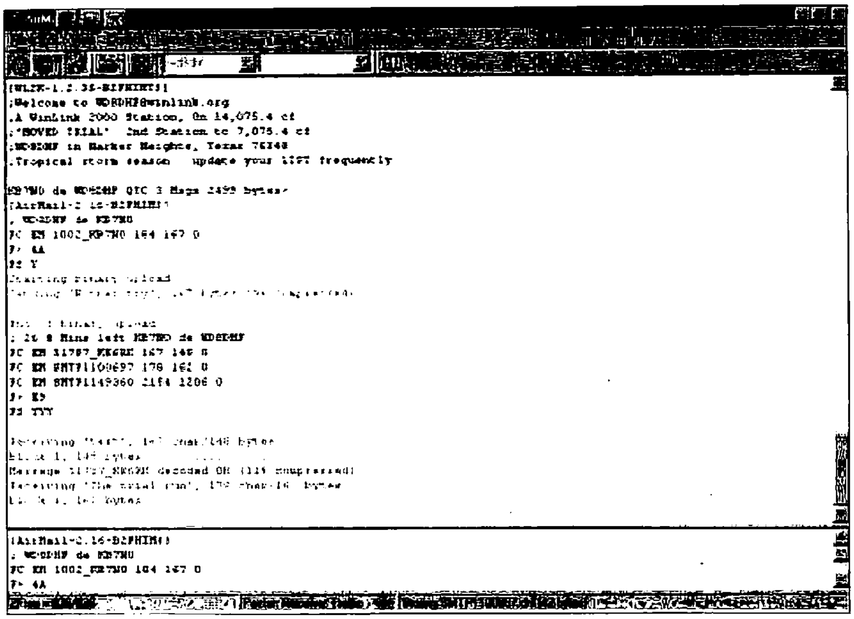

Fig. 1. Screenshot — This is a live shot of the Airmail terminal window showing an automated session uploading and downloading message files. In the upper left box is the callsign of the network station which is entered before clicking the "connect" icon which is the farthest round object to the left of that window. "The Connected/Welcome" header varies from station to station according to necessity. After the break in the lines the automated process begins. The first line indicates I have 3 messages totaling 2499 bytes. During the next two lines an automatic changeover has taken place and my station sends a message that I have a message to upload that is 167 bytes. Then an exchange of commands and the WinLink 2000 network receives the upload which has been automatically converted to a compressed binary file. After that is completed, downloads are begun to receive my mail from the network. After all this was accomplished, the link was disconnected, again automatically. In viewing the automatically decompressed files I found that not a single error had crept into any of the messages going in either direction. All you have to do is make the connection via PACTOR to a

The Digital Port

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would have it. There are plenty of stations in California but that is often a bit too close on 20 meters.

As I understand the system, if you follow the procedures to the letter, the frequencies listed in the frequency chart will get you right on the money as long as the list is kept current. In my case, I didn't follow the procedure carefully and still had successes.

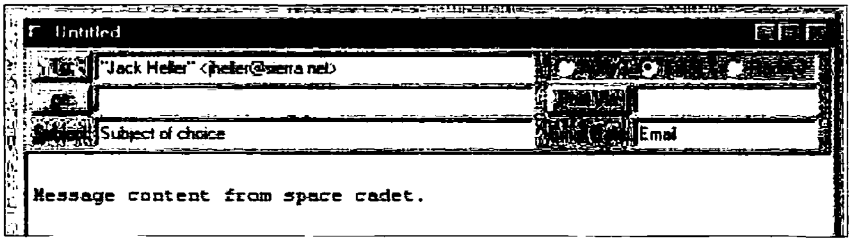


Fig. 2. Easy to address — This is a pseudo-message to my E-mail address. There are only three elements necessary — (1) The E-mail address at the top. (2) The "Post via" box (I inadvertently left it blank). If you click the button a drop down menu appears for preselected network stations or you can manually enter the callsign of your choice (or, best way, enter "ANY" and the system is not picky). And (3) your subject and message. The buttons to the top right are selected automatically according to the type of address you enter. Below is the message area. When you have finished your message, in the background, outside the message composition window shown here you will find an icon of a mailbox. You click on that and it is posted, ready to upload by the automated system.

I was able to calculate an "offset" constant to add to the one shown, thereby making the list usable for the purpose of the review. The method I used is described just a bit further down the column. The best method is to get connected, check it out and see if this is for you. Then update the frequency chart.

And before I forget, use LSB. PACTOR really doesn't care which sideband you use for its operation but it is recommended and you will be consistent when you are discussing frequency with other users. I understand this is not wholly true with marine radios but I have no experience there, so must not comment.

How I tuned ... If all else fails ...

What I did was listen during an active time and find the network station being contacted and identifying itself. Then it was a simple matter to go to the frequency chart, read the frequency listed and compare that to the readout on the rig. A quick subtraction and I had the number to add to the chart listing so I could tune the rig. This same magic number works for all the frequencies for me. Mine is 2.2 kHz, just to give you an idea.

I have to admit I think I understand math, but when I follow the instructions and it doesn't work out, I just make up my own rules. Been doing that since I was a kid in school. I used to blame it on poor teaching, but it is still happening, so I probably have a "noisy diode" somewhere between the ears. Never gets any better or worse though.

Anyway, once you have the offset figured for your setup, you are in business. The only variable you contend with after that is propagation. With the participating stations using all the HF ham bands, there should seldom be a time or place where you will not be able to make connection.

You will find that after you have mastered the connection process, the rest is a piece of cake. Once you make the PACTOR connection, the software does all the rest right up to and including the disconnect.

In the live screenshot you can see how this works. This is most of a connected session where the Airmail program automatically sent a test message to my E-mail box and received three messages. The incoming messages are automatically stored for easy access through another window known as the Message Index. Go to the window and double click on a message and read it. Print it if you like.

There is an address book just like you have in your regular E-mail program. You

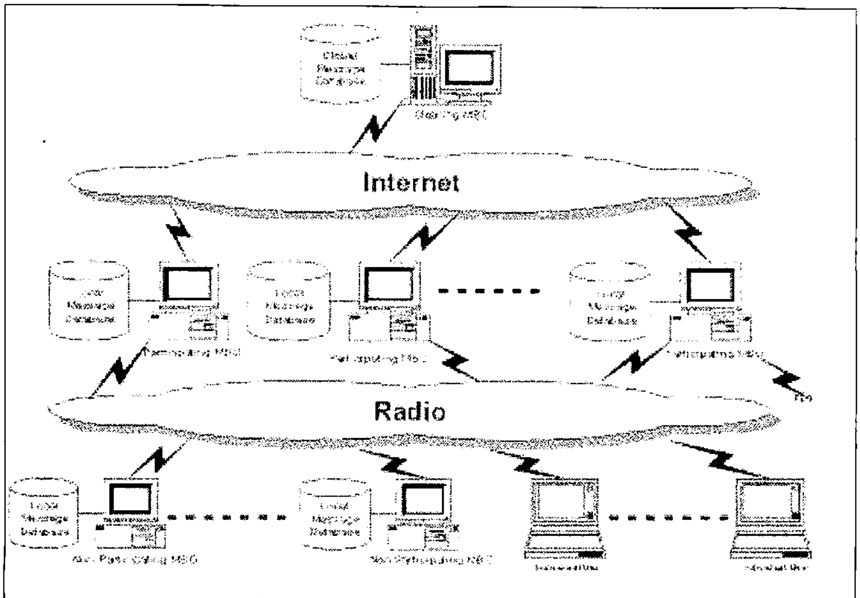


Fig. 3. System screenshot — This gives an overview of the inner workings of the WinLink 2000 network. Even those of us who are not programmers have to admire how this many computers can work together so flawlessly. That top server, if it is in reality only one, has a lot of work cut out for it. The second tier seems most likely by the casual observer to be the one to get "out of control" as it has to relay so much information to and from end users in such a format that none of the involved subsystems become confused. And, unless I am mistaken, those three computers represent all the network stations around the world and when you check the frequency list, that is a bunch. And this system has to contend with the management of 300 messages each day from over 3,000 users around the world. At any time, any user can connect anywhere in the network and receive mail addressed to him that was entered at any point throughout the world and the system handles all the details. These folks have done an excellent job of putting this together.

can store E-mail addresses of friends and family to make addressing a snap.

Speaking of family and friends, the service would be hard pressed to receive the volume of mail some of us are accustomed to by use of the Internet. The real purpose of the WinLink system is to provide a means of staying in touch with a select few while away from home.

Just a few more interesting notes

I didn't give it a try, but WinLink 2000 also includes an APRS system to allow tracking of users. Can be a very handy feature so your friends can watch your progress and could even be an interesting way to present a geography lesson at the receiving end. (Check out the WinLink 2000 Web site listed in The Chart.)

Plus, hams can communicate using WinLink 2000 in a method very similar to the way the packet network operates. That is, you can address messages to another ham WinLink 2000 user without sending it out to the Internet E-mail path.

Another great feature available is that you can send and receive binary attachments just as you would with regular E-mail, but you will want to limit the size, if for no other reason, to be gentlemanly (or ladylike?) and to conserve time and space for other users.

With the above in mind, you will not be

Source for:	Web address (URL):
Mix W Soundcard program for PSK31, RTTY, new modes, MTTY, FSK31, more	http://tav.kiev.ua/~nick/mixw2/ www.nvbb.net/~jaffejim/mixwpage.htm
FREE MMHam site — MMTTY — MMSSTV	www.geocities.com/mmhamsoft/
FREE VK7AAB — SSTV-PAL — PSK-PAL	http://users.origin.net.au/~crac/
Much ham info w/SSTV downloads	www.conknet.com/~kb1hj/index.htm
TrueTTY — Sound card RTTY w/ PSK31	www.dxsoft.com/mitrtty.htm
Pasokon SSTV programs & hardware	www.ultranet.com/~sstv/lite.html
PSK31 — Free — and much PSK info	http://aintel.bi.ehu.es/psk31.html
Interface for digital - rigs to computers	www.westmountainradio.com/RIGblaster.htm
Soundcard interface info — includes Alinco	www.packetradio.com/psk31.htm
Interface info for DIY digital hams	www.qsl.net/wm2u/interface.html
WinWarbler info and free download	www.qsl.net/winwarbler/
MFSK-related tech info — how it works	www.qsl.net/zl1bpu/
Throb — New — lots of info	www.lsear.freeserve.co.uk/ www.btinternet.com/~g3vfp/
Download Logger, also Zakanaka	http://www.qsl.net/kc4elo/
PSKGNR — Front end for PSK31	www.al-williams.com/wd5gnr/pskgnr.htm
DigiPan — PSK31 — easy to use	http://members.home.com/hteller/digipan/
TAPR — Lots of info	www.tapr.org
TNC to radio wiring help	http://freeweb.pdq.net/medcalf/ztx/
ChromaPIX and ChromaSound DSP software	www.siliconpixels.com
Creative Services S/W Multimode w/PSK	http://www.cssincorp.com/products.htm
Timewave DSP & AEA (prev.) products	www.timewave.com
Auto tuner and other kits	www.ldgelectronics.com
XPWare — TNC software with sample DL	www.goodnet.com/~gjohnson/
RCKRtty Windows program with free DL	http://www.rckrtty.de/
HF serial modem plans & RTTY & Pactor	http://home.att.net/~k7szl/
SV2AGW free Win95 programs	www.raag.org/index1.htm
Source for BayPac BP-2M & APRS	www.tigertronics.com/
Int'l Visual Communications Assn. — nonprofit org. dedicated to SSTV	www.mindspring.com/~sstv/
Hellschreiber & MT63 & MFSK16 (Stream)	http://iz8bly.sysonline.it
HamScope — multimode w/ MFSK16	http://users.mesatop.com/~ghansen/
YPLog shareware log — rig control — free demo	www.nucleus.com/~field/
WinLink 2000 System info	www.winlink.org/k4cjx/
Airmail — free program to use WinLink 2000	www.arimail2000.com/

Table 1. The Chart.

surprised there are graphic and text based weather downloads so you will know what you may encounter in your travels. And these can be invaluable when you are at sea. The weather maps include all the surface of land and sea, so you will know when a storm is coming your way wherever you sail.

And you will learn also that you can use your Web browser to access WinLink 2000 on the Web and manage your account when needed, such as if you are land-locked and cannot get on the air.

You will find the transfer of files is relatively slow unless you have one of the newer SCS controllers. I don't and the transfer that took place in the accompanying screenshot must have taken about 5 minutes of connect time. The claim is the speed increases by about four or five times by use of the newer SCS equipment with the PACTOR II format.

But I can put up with the lack of speed for a time until I get to be "serious" about the mode. It is really a very good solution to a problem that just won't go away. E-mail is here to stay and we have to cope with it by whatever means is available. This looks to be a good one.

Just about everything you ever wanted to do with E-mail via the ham radio is now available and many of you have all the equipment required to do the job. You are just one software installation and set up away from keeping those contacts alive from wherever you travel.

MixW 2 gets updates

As this is being written, the seventh release version of MixW 2 is making its rounds, a real accomplishment in ham programming. If you watch the MixW reflector on the Internet you will see some real success stories. The software has certainly done a lot to attract attention to some little used modes.

Though the novelty is waning, I still see and hear Throb on 20 meters where it was never used until it was included in the MixW 2. Also, Hellschreiber signals can be found in parts of the 20-meter band other than 14.063. I think that is an indicator of new interest.

There have also been a lot of questions posted to arrange schedules for MT63, another fine mode that has taken a back seat for a long time. If Nick UT2UZ, the author of MixW, has made a contribution, it is to make all these modes easy to use and switch between.

Personally, there were many times in the past when I would see a signal in a mode other than the one I was using and I would ignore it because of the time consumed changing software. Now it only takes a few clicks to change modes, the waterfall or spectrum does not disappear and I am ready to make a new friend or to work an old one on a different mode.

It is difficult to say where all this is going with this product, but you can observe folks asking for more refinements and additional features and the programmers are considering them. There seems to be no end to the development of the digital ham software arsenal. And we are getting quality products.

Quick visit to DXLab

Another area I have not visited lately is the one authored by another ham programmer,

Continued on page 58

QRP

Low Power Operation

Mike Bryce WB8VGE
SunLight Energy Systems
955 Manchester Ave. SW
North Lawrence OH 44666
[prosolar@sssnet.com]

Antenna Talk

Last month we talked about running HF in the field or from a campsite. Since the radios have shrunk to the point of pocket size, the only draw back we now have is the HF antenna.

When we speak of QRP operation, most of us usually conjure up images of dipole antennas strung up between two huge oak trees. In reality, that's not usually the case. Even at home, antennas usually have to be sized to fit the property.

Not everyone can install a full-size 80-meter antenna on his or her city lot. Therefore, some sort of compromise antenna must be used. Usually, the antenna is electrically shortened by the use of traps. These traps are nothing more than a tuned circuit that makes the dipole "look" electrically long but are physically shorter than normal. When it comes to working HF in the field, we can use some of the antennas used in locations where no antennas are permitted.

The random wire

I've used this type of antenna many times in the past. It's about as simple to put up as it gets. As the name implies, the random wire is just that: a wire that is a random length. Usually, I've installed this type of antenna with one end higher than the opposite end. There are a few rules you must watch for: (1) the random wire must be at least 20 feet long and normally not any longer than 90 feet. (2) you must use some sort of impedance-matching device to couple the low Z output of your transmitter into the unknown Z of the antenna.

And lastly, there is a good chance that you'll end up with stray RF floating about when you use a random wire. The ol' "hot mic" can sometimes be a problem, especially when running above the usual QRP power level of five watts.

Vertical antennas for portable use

Don't get confused here, I'm not talking about those 34-foot monsters. I'm talking about the small loaded "ham whips" many of us use on the cars. These antennas are wound on a fiberglass shank and are totally weatherproof.

You have several ways of using these in the field. One is to install one on the family Buick and just run some coax from it to the rig. Works great and you don't have to worry about mounting the antenna as it's already on the car.

Or, you can use one whip and then lay out counterpoise wires so the antenna has something to work against. I've seen this done in hotel rooms. You mount the antenna to the railing and then run radials around the room. The antenna is held to the railing via a vise clamp. Usually, you'll need some type of coupler to adjust the SWR to a point at which you can safely operate the radio. Normally, all you need is at least one radial, but the more you have, the better the antenna will work. I've heard of some guys who tie into the plumbing of the hotel room and use that as a counterpoise for the antenna. I guess that would only work in a hotel with metal drain and supply lines!

Taking the above example one more step, you can use two ham whips. Instead of using wire for the radials, use the second ham whip. Connect the coax feed to one whip and the shield from the coax to the other whip. I've used this on 10 meters and it seems to work just fine. I've modified a CB mirror mount to hold the two antennas.

As in any antenna, the higher, the better, especially when using the whip antennas. If nothing else, you must get them up high enough so you don't run into them.

The Isotron antenna

Put this one down in the really strange category. It's odd looking and comes with a

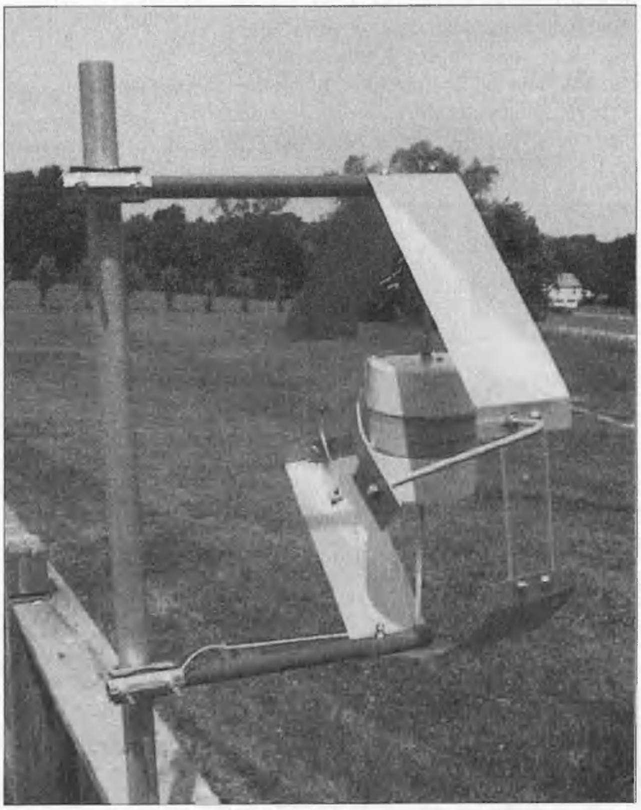


***Photo A.** This strange looking thing is really an antenna. It's the Isotron mini antenna for 40 meters.*

Photo B. *A portable antenna tuner is a must for field use. This MFJ 971 is ideal for camping or Field Day use.*

very small footprint. You can mount the Isotron on just about anything. And what's really great about this antenna is that you don't have to worry about grounding it.

I picked up an Isotron for 40 meters. It's bigger than a breadbox but not by much! You feed the antenna with 50-ohm coax. There's no need for an antenna-matching device, but I'll have to admit it, I used one anyway.

I used a hunk of TV mast pipe to hold the Isotron together. The whole shebang is mounted on one side of my outside deck using tie straps. To say the least, it's not mounted very permanently. A short run of RG-8X cable is connected between my Argonaut II and the Isotron. Although not exactly camping out, I can sit on the deck and play radio. When the rains come, I just grab the radio and run inside the house. Now, that's MY idea of roughing it!

The Isotron comes as a monoband antenna, i.e., 40 meters. You can add on a second band if you want. It's possible to have a 40- and 20-meter Isotron antenna. One feedline does double duty. The 80- and 40-meter combo is very popular. You can easily mix different bands if you so desire; contact the Bilar Company for more details.

So, how does the Isotron work? Well, considering its size, it's amazing it works at all. I've been 559 into most of the East Coast with nothing more than the five watts from the Argo II and the Isotron.

The High Sierra antenna

I've been watching this company for some time. They started out making adjustable mobile antennas. Based on the screwdriver design, they are designed for mobile use. The best thing about these antennas is the ability to adjust to different bands by moving the slider inside the antenna. This way you can change bands and not have to stop the car to move taps or change whips.

But what got my attention is the new HS1500MVA for use in restricted lots or in campsites. The HS1500MVA is only seven feet high and, like the other High Sierra antennas, is remotely tuned. I don't have much more info, but it sure looks interesting.

Antenna tuners

Unless you're really lucky, you will need some sort of antenna-tuning device. That's not exactly the correct name, they really don't "tune the antenna." Instead they should be called "impedance-matching networks." You can use one of the new autotuners from LDG or a homebrew random wire tuner. Using less than perfect antennas in the field will almost always require some sort of tuner.

One of the slickest antenna tuners about is the Z-11 QRP autotuner from LDG Electronics. One of the nice features of this autotuner is the zero current requirements once the antenna is tuned. This tuner uses latching relays to reduce standby current to about nil. And, the Z-11 has just about the same footprint as the new Yaesu FT-817.

I use one of the MFJ portable tuners. It's small, has a built-in SWR and wattmeter, and is not overly expensive. The only downside I find is that you can't bypass the tuner.

A portable antenna holder

Yup! It's the strangest thing you will ever come across. A telescoping mast made of fiberglass. It will expand up to 30 feet and collapse down to only four feet. You can get one from Kanga US. They're about $100, but if you do a lot of portable HP, they are well worth the money.

Some final thoughts

No matter if you're set up at a state park or handing out counties for the county hunters, you're going to be in the public's eye. CW blasting from a speaker in a campsite might be music to your ears but noise to someone else. You must respect the right of the other guy who is camping next to you. Maybe all he and his family wanted was to

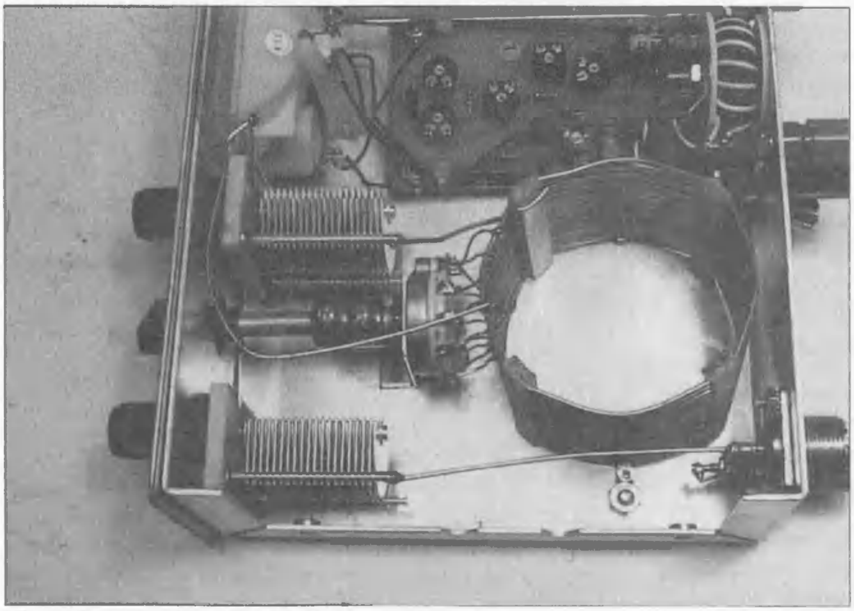


Photo C. *Inside the MFJ 971. Not much there. Antenna tuners make great home-brew projects.*

"get away from it all" and not be blasted by your radio. Use headphones!

Keep any antenna you install up and out of the way. The last thing you want to do is have someone run into or trip over your antenna or coax.

In some locations, you may not be allowed to install an antenna. Respect those rules. If you can't erect an antenna, use the mobile mount on your car instead.

Even at five watts, using less than perfect antennas can cause havoc with entertainment devices. Talk about TVI! Can you just imagine two campers set up in the KOA campsite near Dayton during Hamvention?

All they want to do is watch a little TV before hitting the sheets. Little do they know they are camping with a zillion hams all set up for portable HF.

No matter what you do, a good dose of common sense will go far. Take care when operating HF portable and you'll have a lot of fun.

Looking for HW-7, HW-8, and HW-9 modifications

Do you have a modification to any of the Heathkit QRP radios? If so, I would be interested in seeing what you have. I've been kicking the idea of a third edition of the *HW-8 Handbook*.

Send your mods, no matter how simple or how complex, to the address shown at the top of this page. Or you can E-mail them to me at [prosolar@sssnet.com].

And speaking of Heathkits, check out my Web site. Point your browser to: [http://www.theheathkitshop.com]. Here you will find all sorts of schematics, PC board layouts and repair tips for many of the Heathkit radios. There's the alignment data and PC board layouts for the HW-8 up there now. I am constantly adding more stuff. Check it out!

Next time we meet, I'll show you some troubleshooting tips to get that broken QRP rig back on the air.

People and places

Isotron Antennas
Bilar Company
(719) 687-0650
[www.rayfield.net/isotron]

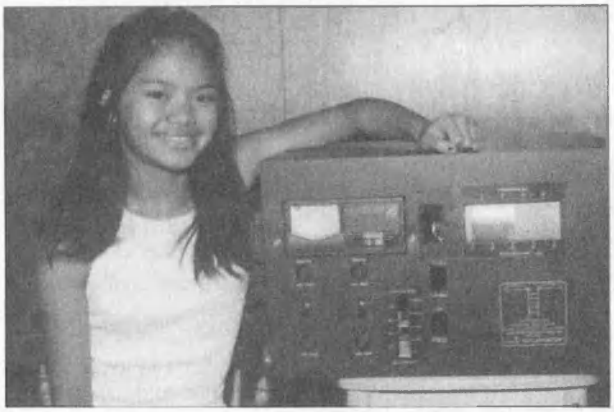
High Sierra Antenna
(530) 273-3415
[www.cw73.com]

LDG Electronics
Many dealers, including Ten-Tec, sell the LDG autotuners
[www.ldgelectronics.com]

Lakeview Company
HamSticks
(864) 226-6990
[www.hamstick.com]

Kanga US
(419) 423-4604
[www.bright.net/~kanga/kanga]
[Kanga@bright.net]

If you're a No-Code Tech, and you are having fun operating, tell us about it! Other No-Code Techs will enjoy reading about your adventures in ham radio—and we'll pay you for your articles. Yes, lots of nice clear photos, please. Call Joyce Sawtelle at **800-274-7373** to get a copy of "How to Write for *73* Magazine."



New Motorized Tuners

Bliss Z MatchMaster, a division of Air & Water King, Inc., has introduced two new HF tuners to their product line. These tuners are motorized versions of the balanced-balanced tuners. They are designed primarily for balanced feed antenna systems but will also match unbalanced feedlines.

They are built for high power operation: One model is for local use at the operating position and the other for remote operation, in or out of the operating room.

Both models feature two large variable inductors (3" diameter by 5" long), made of silver, which were manufactured by Collins Radio. The vacuum variable capacitor was made by Jennings Radio, and two vacuum relays by Eimac. They also feature a VSW and power meter. These high-quality tuners are a "Limited Edition."

For more information, visit their Web site at [www.airwaterkinginc.purification.com]. E-mail [angelie@bliss.org], or call (970) 882-3922.

SafeTenna Now Available

Creative Services Software and AB4MT-Designs have announced that the SafeTenna is now available for 2m. Invented by Michael Thigpen AB4MT, the SafeTenna was designed for use in emergency, travel, or portable operation. The solid design of the antenna allows for RF use, as well as double duty as a walking stick when you might be operating portable.

AB4MT notes: "The SafeTenna was designed to be an emergency antenna. I designed it to be used for bad locations and situations, such as when you have car trouble and your cell phone is out of range. You can keep the antenna in the trunk or behind the truck seat with coax and string to put up in time of need. That is where I got the idea for the name. It's a portable antenna that can help you make a contact that is needed when other attempts fail."

The SafeTenna comes in two sizes, full and compact, and is encased in a solid PVC shell. It retails for $39.95 and comes with a 1-year warranty.

For further information, contact Creative Services Software at 503 West State Steet, Suite 4, Muscle Shoals AL 35661; (256)-381-6100; [sales@cssincorp.com].

Ham Radio Market Web Site from WIA

The Wireless Industry Association, founded in 1986 by long-time ham and amateur radio enthusiast Bob Hutchinson N5CNN, has announced its continuing support of the ham radio community with the opening of a new Web board, [http://hamradiomarket.com].

Hutchinson says, "Ham Radio Market is a fast-moving Web board where hams can seek, find, buy, and sell anything in ham radio. The ability of serious purchasers to network at hamradiomarket.com is certainly new and innovative in the ham radio industry."

Information and details of prizes to be given away to sweepstakes winners for each week can be viewed at [http://hamradiomarket.com/sweepstakes%20prizes.htm].

Each ad or message is related to Ham Radio Market purposes. Hutchinson further notes: "Networking at the market on a dealer-to-ham basis with URLs to Web pages and pictures is especially encouraged. We invite all those in the ham radio community to post ads and messages about promos, specials, and new and used items, with details, prices, and URLs of their facility or Web pages. Buyers are encouraged to post "seeking new equipment" messages on a ham-to-dealer basis for dealers' or manufacturers' response. New or used — search, find, buy or sell it at the Wireless Dealer Market."

Browsers or users can go directly to Ham Radio Market at [http://hamradiomarket.com]. Users should click "Post Ad or Message" to quickly create their ads or message (good instructions are there, too).

The WIA was formed as a grassroots affiliation of cellular agents and dealers. Today, association members operate over 25,000 wireless outlets, and sell and activate over half of all wireless devices. The Association's Web site, [http://wirelessindustry.com], is the most popular one worldwide for buying and selling equipment in the wholesale wireless industry.

Am-Com Frequent Buyer's Club

Am-Com, Inc., amateur radio dealer and manufacturer of the ClearSpeech speaker, has introduced a Frequent Buyer's Club. With your first purchase worth $150 or more, you receive free membership.

Along with membership comes a 2% credit on all future purchases, which can then be redeemed for future Am-Com acquisitions. Members also receive double the manufacturer warranty on all Am-Com equipment.

For further information, contact Am-Com at 1-(800)-803-5823, or visit their Web site at [www.amcominc.com].

By Eric Shalkhausser W9CI, SK

The History of Ham Radio

Parts 11 and 12: More 1920s, two-way trans-Atlantic, the IARU and The Hoover Conference.

The post-WWI years from 1920 to 1927 found the mushrooming radio industry still in its infancy, but struggling to find a foothold — very much in need of direction. It was a new technology still in relative obscurity awaiting a Midas touch!

Radio did not have a definite pattern by which to gauge its destiny. From the very beginning it was partially inundated with revolutionary inventions and new developments, many of a questionable nature. There existed no guidelines to follow in this new field.

The introduction of numerous bills in Congress to update the 1912 Wireless Act merely aggravated the situation. The end of hostilities, the conversion from a war to a peace climate, resulted in the creation of many new companies, large and small, seeking to take advantage of this developing, growing industry. Here existed a "made-to-order" opportunity for questionable financial interests to inundate a lucrative market with investment stock schemes. An unwary public remained confused, except for the wide-awake radio amateur, to whom these conflicts meant very little. His interests were directed toward testing all the new gadgets flooding the radio market and experimenting with the numerous circuit arrangements that were perpetually introduced through dealer folders and pamphlets. In general, this game of wireless had him spending many hours at the Morse key, exchanging messages via the established relay routes and frequently exchanging radio signals with neighboring and foreign countries.

Outstanding researchers and inventors, personalities of the stature of Major Howard Armstrong, for one, and men on the technical staff of the ARRL — John Reinartz and S. Kruse, among others — introduced circuit designs under such names as "re-generative," "heterodyne," "neutrodyne," "superheterodyne," and "reflex," all of which provided the amateur with endless hours of experimental activity.

The 1923 challenge across the Atlantic

During the winter of 1922, our radio amateur had succeeded in spanning the Atlantic Ocean with his wireless signal operative on 200 meters, but only in one direction — from the United States to the British Isles. He did not have to be encouraged to tackle the two-way spanning. Active steps were taken by the ARRL to accomplish this feat, this time giving all amateur radio stations an opportunity to participate in the effort. The results which the experimenter was having with the wavelengths below 200 meters, going down to 150 and even down to 100 meters, provided renewed activity and a desire for some real DX. All the planning and the cooperation soon produced astonishing results.

On November 17, 1923, there was a headline banner across the amateur radio horizon. For the first time in history, the Atlantic Ocean was bridged by amateur radio in two-way contact with an exchange of messages. Distance records were quickly attained via two-way phone contacts with stations in Hawaii and Alaska, Japan and Australia, and the American continent. This was a year of jubilation.

The language problem

With the crossing of the Atlantic and the contacts now possible with foreign countries, there arose a request on the part of many to solve, in some way, the language problem for better exchange of messages. The question was how to

Reprinted from *73 Amateur Radio,* March 1980 & 1981 where this was originally reprinted from *QCC News,* a publication of the Chicago Area Chapter of the QCWA.

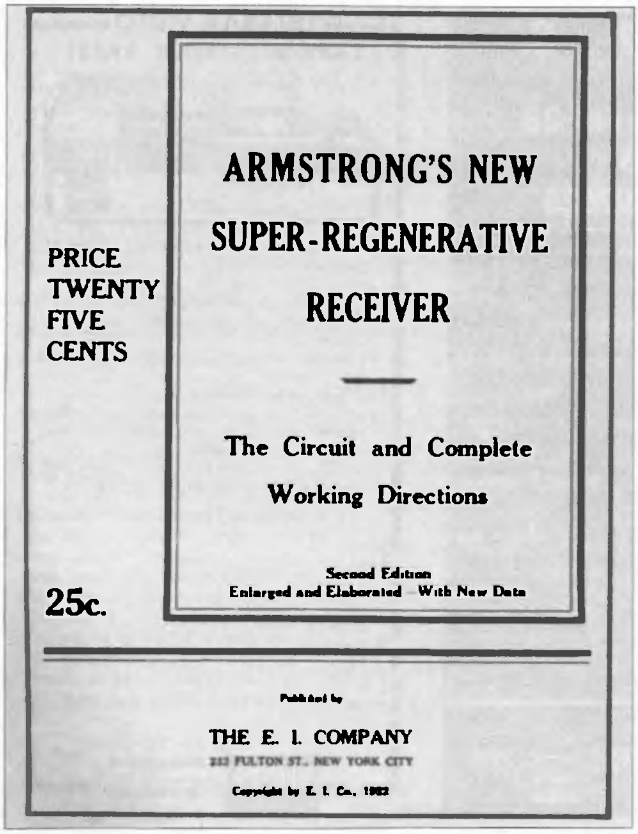


Photo A. What a caption!!! Most original!

do it. There was immediately suggested an International Language, an IL, for short, to facilitate common understanding. At the beginning, such a proposal was regarded as indispensable. A well-established Esperanto system of word and sentence construction was in use in many countries and was extensively used at conventions and other gatherings with considerable success. Esperanto was considered to be valuable as a rapid means of common understanding. However, the use of the synthetic language proved too "burdensome" and "uncommon" to the majority of amateurs and, through neglect, was soon forgotten.

Solving the call letter identity problem

The early assignment of call letters among United States amateurs was simple. The district number was followed by either two or three letters of the alphabet. But, as Canadian and foreign stations with similar and often identical call letters were contacted, confusion arose unless an additional first character was added. To correct this problem, the ARRL initially suggested that the United States amateur simply use "de" and the Canadians the letter "v" before giving their call. This soon proved inadequate and gave way to an assigned alphabetical letter as follows to which all agreed and used.

A — Australia
C — Canada
F — France
S — Spain
U — United States
G — Great Britain
I — Italy
M — Mexico
R — Argentina
Z — New Zealand
N — Netherlands
O — South Africa
P — Portugal
C — Cuba

These letters, however, did not conform to those assigned by the countries' respective governments. This plan was first adopted as of December 15, 1922. Additional letters were required from time to time and assignments were made by the ARRL Operating Department. Several two-letter prefixes were needed toward the termination of this method of call-letter designation, i.e., FN — Finland and CH — Chile. The letters were used for a time by all amateurs except in Britain, where such permission was not granted.

Continued on page 52

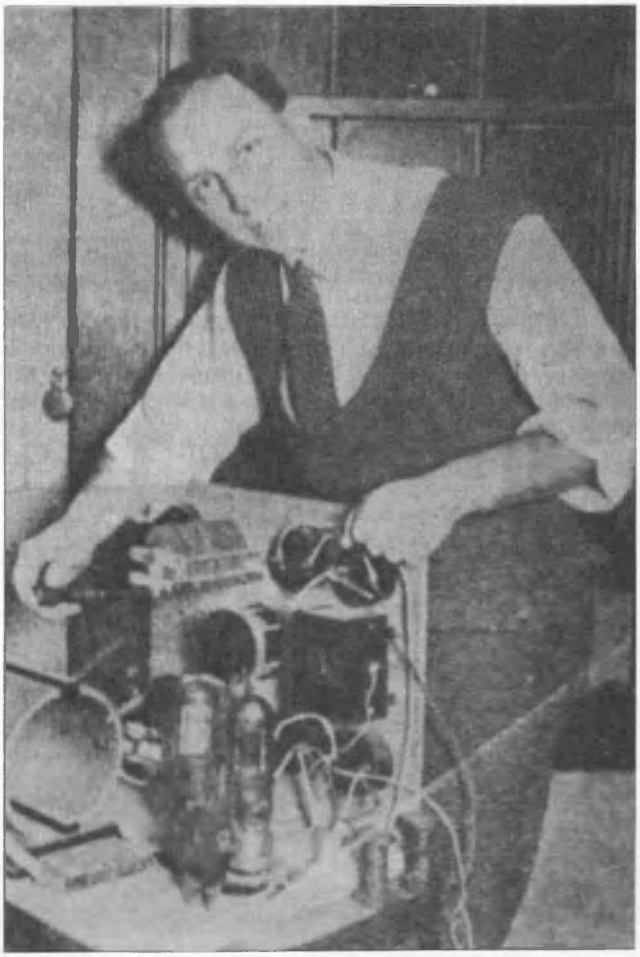


Photo B. John L. Reinartz and the set at 1QP-1XAM.

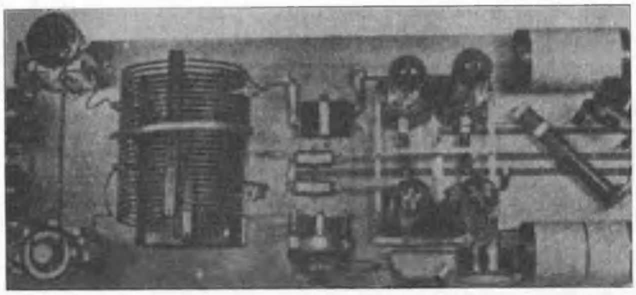


Photo C. *The transmitter at 1MO-1BHW which, under the call 1MO and on a wavelength of 110 meters, was the first American amateur station to connect with an European amateur. This set was built in accordance with the scheme outlined by John L. Reinartz of 1QP-1XAM.*

The History of Ham Radio

continued from page 51

Worldwide amateur radio — a reality in fact

As more and more international amateur radio contacts were consistently and regularly logged, serious consideration was given to an international radio amateur organization, eventually to be affiliated with the American Radio Relay League. In the making was a relay circling the globe, thus involving amateurs worldwide linking all continents! This was the ultimate challenging thought for amateur radio. No sooner was this idea proposed than the ARRL board of directors commissioned its president, Hiram Maxim, to call together all interested foreign amateurs for an early meeting. The United States and Canadian amateurs, with years of experience and with an established organization nearing 20,000 members, were expected to provide leadership and guidance toward making an international amateur radio relay league a challenging asset for world communication.

So, on March 12, 1924, in Paris, France, the amateur representatives of nine different countries — France, Great Britain, Belgium, Switzerland, Italy, Spain, Luxembourg, Canada, Denmark (absent), and the United States — sat down together, deliberated for several days, and formulated the beginning of the International Amateur Radio Union. Appointed at the meeting was a temporary Committee of Organization to select and approve a permanent name, a constitution, and operating procedures. During Easter 1925, the IARU was officially declared a permanent organization. with Hiram Maxim as its first president.

The wavelength breakthrough for amateur radio

For a number of years, and especially during 1923, desire and hope were on the minds of the amateurs for expanded operation on the lower wavelengths. Many experiments conducted in trials and contacts proved convincingly that the higher frequencies could be depended on to provide consistent DX. Again through the efforts of the ARRL, the Department of Commerce, during the summer of 1924, issued the following letter directed to all supervisors of radio:

Photo D. *1MO and his "hay-wire" receiver with which he worked F6AB.*

Department of Commerce
Bureau of Navigation
Washington
July 24, 1924
To: All Supervisors of Radio

Sirs:

Effective this date you are authorized to issue general and restricted amateur radio station licenses to permit the use of any one or all of the following bands of short wavelengths: 75 to 80 meters, 40 to 42 meters, 4 to 5 meters, in addition to the band 150 to 200 meters, provided application is made by the owner of the station, which station must be prepared to use the wavelength, or wavelengths, requested.

The use of continuous wave telegraphy only will be permitted on wavelengths other than 150 to 200 meters, and the antenna circuit must not be directly coupled to the transmitting circuit.

Silent hours will not be required of amateurs while using the wavelengths within the above bands below 80 meters except where the transmitting station is so situated as to produce objectionable interference with other services.

Hereafter, special amateur stations will not use wavelengths above 200 meters. They may be authorized to use the bands of wavelengths from 105 to 110 meters in addition to the wavelengths within the bands authorized for general and restricted amateur use, where the special amateurs are engaged in conducting tests with government or commercial stations.

General, restricted, and special amateur stations will be permitted to use the entire band of wavelengths from 150 to 200 meters employing pure CW, spark, and modulated forms of transmission.

It should be made clear to the amateurs that the authority granted above is necessarily tentative because of the rapid development taking place in radio communication, and the bands of wavelengths authorized may be changed whenever in the opinion of the Secretary of Commerce such change is necessary.

With the assignment of the five new wave bands, amateurs enthusiastically

entered a new radio communications era. Regular licenses had to be modified by district supervisors. No longer was the amateur confined to the selection of one or maybe two frequencies as specified on his former license permit. From now on, the operator had greater flexibility in choosing desired operating frequencies.

Amateurs were requested by the department to make immediate use of these broadened privileges so that the bureau could gather vital information and determine practical usage in this spectrum. The new bands were made available on an "until further notice" basis. To assist in reducing broadcast listener interference, specific types of carrier modulation and types of power supplies at the transmitter were prohibited, i.e., spark, phone, and ICW modulation were declared out. The "silent hours," stipulated at lower wavelengths, were canceled for the higher frequencies. The 150- to 200-meter band was opened up for any and all uses.

These newly assigned wave bands materially broadened the operating range for the amateurs. They had been clamoring for either space and were anxious to readjust their experimental circuits and antennas for a go at these higher frequencies. A calibrated wave meter became vital. Still required by all radio amateurs was an operator's as well as a station license. A code speed requirement of 10 words per minute prevailed.

The 1924 White Bill, HR 7357 — and others

On February 28, 1924, Congressman White, Chairman of the Subcommittee on Radio, introduced a new bill to abrogate the old Wireless Act of 1912, declaring that the original law had outgrown its usefulness.

The White bill was aimed at vesting all administrative powers pertaining to radio in the hands of the Secretary of Commerce. He was to classify all radio stations as to wavelength, licensing, hours of operation, type of equipment, and power. In short, the secretary would have complete jurisdiction over all radio activities and facilities. As the general hearings on the bill proceeded, it became evident that the radio amateur, especially the ARRL, would be negative about the overall stipulations in the bill. They felt that such broad discretionary powers in the hands of one individual would be too dangerous. Other interested parties at the hearing expressed similar negative views on the bill.

By May, 1924, the structure of the White bill, as it had initially been presented, had gone thorough a series of changes and maneuvers. Provisions were combined with a similar bill, the Howell bill, S 2930; it was considerably modified again, but in the end remained the White HR 7357 document, as an acceptable paper in line for ultimate passage. In its final form, it incorporated appeals against unfavorable decisions in the issuance of licenses and other activities. Throughout the hearings, amateurs received favorable consideration.

At this stage in time, however, the conditions surrounding all radio communication in the United States required extensive exploration and far more research and legislation. Secretary of Commerce Hoover stated that eventually radio broadcasting would of necessity have to be considered within the field of public service and divorced from private enterprise altogether. Hoover proposed sending a bill to Congress outlining his views. The evidence was clear — a National Radio Conference was in the offing.

***

The assignment to radio amateurs of the shortwaves below 100 meters brought about a general awakening to the value of this spectrum. In 1924, the broadcasting industry exerted great effort toward the adaptation of short wavelengths to give their programs added coverage to distant listeners by interconnecting stations across the country.

The Hoover Conference was scheduled to meet in the fall of 1924. Invitations were directed to all radio groups interested in the hearings, in which existing technical radio problems were to be explored. The assembly was to make recommendations to the Department of Commerce for important revisions of then-existing wavelength assignments, allocations, limitation of power, division of time, and such problems which relate to general reduction of station interference.

Of major importance, however, was the subject of shortwave usage by broadcasters and commercial stations. The amateurs, supported by the Department, with their constant experimenting with the higher frequencies, had been providing the industry with interest in these higher-frequency ranges, demonstrating their effective capabilities. The radio law of 1912 had given the amateurs, through assignment, the use of all waves below 200 meters.

The Hoover Conference was called on to revise and to somehow "make amends" to a region in the spectrum which proved to be not only large but of great future value.

The conference sessions continued from October 6 to 10, 1924. Although radio broadcasting held the center of the stage as far as the broadcasters and listeners were concerned, the radio amateur had by all odds top interest in the outcome of the deliberations. The situation, with about 600 broadcasting stations on the air, with foreign stations all over the world striving to be heard, with a wavelength revolution having set in, and with practically no worldwide rules and regulations to give direction, loomed chaotic in the radio broadcast world.

All the higher frequencies below 200 meters, formerly regarded as unsuitable for commercial purposes, were now eagerly sought as of major importance for DX transmissions. The Hoover Conference was set to scrutinize these short-wave regions.

The use of spark transmission, although not ruled out completely by existing laws, nevertheless received its doomsday with the announcement at the conference that all spark should be discontinued by amateurs as well as the commercials. Spark discharges of whatever type and kin caused much of the interference encountered and should be avoided.

The conference gave the broadcasters five wavebands in the short-wave-

Photo E. Secretary of Commerce Herbert Hoover.

length region for use primarily for relay broadcasting. All actions taken at the conference were recommendations to the Department, pending further outcome from future legislation.

The conference concluded by listing wavelengths in effect for one year. All wavelengths from zero (0) to 3158 meters were allocated. The radio amateurs retained the previously assigned wavebands as confirmed, with minor changes, as shown in **Table 1**.

The government departments were authorized to work in the wavebands below 150 meters "with due regard to the authorized use given to other legitimate services."

To be noted was the method of allocating wavebands. Namely, the dovetailing of assigned ranges in such a manner that the frequencies in one band were octaves of those in the preceding band. This manner of band distribution for all services receiving assignments would, therefore, cause disturbances only to the respective assignees operating from one band to the other. Note the distribution, for instance, for the radio amateurs, all being in harmonic relation: 1.5 MHz to 2.0 MHz; 3.5 MHz to 4.0 MHz; 7.0 MHz to 8.0 MHz; 14.0 MHz to 16.0 MHz; 56.0 MHz to 64.0 MHz.

Meters	Kilocycles	Allocation
200–545	550–1,500	Broadcast
150–200	1,500–2,000	Amateur (160m)
137–150	2,000–2,200	Point-to-point
120–137	2,200–2,500	Aircraft
109.2–120	2,500–2,750	Mobile
103.3–109.2	2,750–2,900	Relay broadcasting
85.6–103.3	2,900–3,500	Public service
75–85.6	3,500–4,000	Amateur (80m)/Army mobile
66.7–75	4,000–4,500	Public service/mobile
60–66.7	4,500–5,000	Relay broadcasting
54.5–60	5,000–5,500	Public service
51.7–54.5	5,500–5,800	Relay broadcasting
42.8–51.7	5,800–7,000	Public service
37.5–42.8	7,000–8,000	Amateur (40m)/Army mobile
33.3–37.5	8,000–9,000	Public service/Mobile
30–33.3	9,000–10,000	Relay broadcasting
27.8–30	10,000–10,800	Public service
25.8–27.8	10,800–11,600	Relay broadcasting
21.2–25.8	11,600–14,000	Public service
18.7–21.2	14,000–16,000	Amateur (20m)
16.7–18.7	16,000–18,000	Public service/Mobile
5.3–16.7	18,000–56,000	Beam transmission
4.7–5.3	56,000–64,000	Amateur (5m)
0–4.7	64,000–	Beam transmission

Table 1. 1924 Hoover Conference frequency allocations.

Theory of frequency propagation: Still a mystery?

There existed an unanswered question in the minds of most. Why are 100-meter waves able to carry across oceans at night with little power? This problem baffled the scientists and radio experimenters in the field. Dr. A.E. Kennelly of Harvard University suggested that there must be conducting layers in the upper regions making possible the transmission of radio waves. The layers most likely represented ionizing action to accomplish such results at long distances. As Professor Kennelly theorized, the greater volume activity of the higher-frequency waves enabled them to cut a sharper conducting boundary surface in the upper air than was possible for the longer waves of the lower frequency. The longer waves had a greater tendency to follow the surface of the earth, thus restricting their efficiency.

The Hoover/White Bills

The changing conditions surrounding radio, especially in the field of broadcasting, definitely necessitated comprehensive legislation by Congress. Hoover had in mind a bill in the form of emergency legislation. He thought of the White Bills which had been pending as holdovers from the previous Congress. In communication with Congressman White, his proposal

was submitted in the following form to satisfy the public interest until final legislative policy could be enacted in Congress:

"Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, that it is hereby declared and re-affirmed that the ether within the limits of the United States, its territories and possessions, is the inalienable possession of the people thereof, and that the authority to regulate its use in interstate and/or foreign commerce is conferred upon the Congress of the United States by the Federal Constitution."

That Section 1 of the act of Congress approved August 13, 1912, entitled, An Act to Regulate Radio Communication, is hereby amended by adding at the end of said section the following: The wavelength of every radio transmitting station for which a license is now required by law, its power, emitted wave, the character of its apparatus, and the time of transmission, shall be fixed by the Secretary of Commerce as in his judgment and discretion he shall deem expedient, and may be changed or modified from time to time in his discretion."

The pending White Bill was temporarily sidetracked. The National Association of Broadcasters could hardly disagree with Mr. Hoover's suggestion, so long as he was Secretary, and so long as unfair decisions could be appealed with the consent of the present Secretary.

The amateurs responded by stating that, although the bill needed amending by limiting the life term or by placing the discretionary powers into the hands of some appointed radio commission to provide appeals from unfair decisions, no further suggestions would be forthcoming.

A memorable ARRL undertaking

The evidence of the popularity and the splendid results obtained with shortwaves in the hands of amateurs was clearly exemplified through the experiences conducted jointly with the United States Navy and the ARRL in the summer of 1925.

A shortwave station, call letters NRRL, was placed aboard the *USS Seattle,* flagship of the Navy fleet operating in the Pacific waters. ARRL traffic manager F.H. Schnell assembled the transmitter and receiver along customary amateur radio lines, typically breadboard but compact. Schnell was put in complete charge of the floating station, which was stashed in a small cubbyhole on the compass shack of the ship. There was no other vacant space on board. Schnell strung a single #12 wire vertical antenna up in the rigging of the ship. The Hartley circuit use operated in the 20, 40, and 80 meter bands. For a period of six months, Schnell, as sole operator, made almost daily contacts everywhere. He convinced the Navy personnel that long-range transmissions with low power could consistently outperform on short wavelengths, and had definite value over any of the longwave installations aboard ship. 73

The Cheapest Supplies Ever
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supplies used for computers are pulsewidth-modulated (PWM) such that the duty cycle of the oscillator is varied under regulation control.

Most of the power supplies that I've encountered have used either a TL494 or a KA7500B PWM IC. Within the IC is a built-in oscillator and two voltage comparators along with a voltage reference. In each case that I've observed, voltage comparator pin 1 has been the voltage "sense" pin, but it could also be pin 16 in some designs. **Fig. 2A** shows the top view of the TL494 IC and the function of each pin. **Fig. 2B** shows resistors R1 and R2, which are the voltage sense inputs from the +5 V and +12 V output circuits.

To raise the output voltage a small amount, it is necessary to lower the voltage appearing at pin 1 of the comparator. I've found that adding a resistor in parallel with R3 works well. Because power supplies vary in the values that are used in the sense circuit, same experimentation is required to find the desired resistor value to add across R3.

My suggestion is to tack insulated jumper wires to both pins 1 and 7 to obtain access to the comparator. Extend the wires to the outside of the box, and with the power supply operating and the 12 V output being monitored with no load, place a resistor between the ends of the jumper wires. I'd suggest starting with a 47k resistor and then dropping the value to 22k, then 15k, and then 10k or until the 12 V output rises to perhaps 13.7-13.9 V. When a suitable value has been selected, then tack-solder the resistor between pins 1 and 7 of the IC.

Conclusions

The real answer as to whether a computer power supply is suitable for your application is for you to run some test evaluations and make a decision. If the first power supply fails to work for your application, perhaps as a function of noise, try another supply and evaluate it.

The one conclusion that I can make regarding computer power supplies for ham applications is that they are more valuable in the hands of a ham than in the trash heap. DC power supplies capable of providing 12 VDC at 6-10 A are fairly expensive, while computer power supplies are essentially dirt cheap in comparison.

Try one and see how it performs for you! 73

Your Long-Lost Transistor Notebook
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out circuit values for our amplifier design. Part 4 of this series will begin with determining the resistor values that establish the basic parameters around which the transistor operates.

Additional stops in our tour will take us into determining the input and output impedance of our design, followed up by putting the completed amplifier into use, which requires coupling it to other circuits. Also, putting

our amplifier to use involves frequency roll-off characteristics and the factors that control it.

Movable Microphone Boom

continued from page 21

1" on the several lamps that I've modified) is almost exactly the same as the distance between the two mounting holes on the flange of the SO-239. Thread the 4-40 x 3/4" machine screws through two opposite holes on the SO-239. They may fit a bit tightly, but with a little careful work the screws should "self-tap" the holes. Next, place the 1/2" PVC spacer between the machine screws so that it covers the pin on the SO-239. (Actually, you may find it easier to just cut the pin off.) Slide the ends of the screws through the holes in the flange. Put the lock washers in place and tighten down the nuts. You now have a stable mechanical mount between the SO-239 and the modified flange on the lamp.

Now, all that's left to do is to screw the microphone holder onto the threads of the SO-239 and mount your favorite microphone. Then select a good location for the base of the boom, attach the mount, and you're done!

For a neater appearance, you can run some shielded microphone cable though the same internal channel that the line cord used. And, you can make up a simple switchbox such as I have made to provide easy push-to-talk control — or just go with VOX. Either way, your operating enjoyment has just been greatly improved with the addition of a new, attractive, and versatile station accessory.

Usage notes

The microphone I used for this project is the Yaesu MD-1. Normally, this microphone is mounted on a stand containing the usual switches for push-to-talk operation. Conveniently, it uses the same 8-pin round connector to attach the cable coming from the base as is used to plug into the transceiver. I used the same connector on the boom cable, which allows me to switch the microphone between its original base and the boom as the situation requires. For the final professional touch, I added a foam windscreen (RS part #33-4001).

Acknowledgments

Very special thanks to my wife Margie Bachman KF4UVK for her support, encouragement, and great editing skills. This article is dedicated to the memory of the late Don Shoff AF4IM — a fine man and a great ham missed by many.

Read All About It!

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Thompson got up and put his nose to the vent holes.

Just at that moment Doug and Al arrived, bursting through the front door and racing for the upstairs, with incoherent shouts of explanation to Mom and Dad in the kitchen. They were too overwrought to notice me, about ten feet behind them, and they had reached about the fourth step from the top when the transmitter blew.

It sounded very much like a rifle crack, and was followed in about a second by a sizzling frying sound reminiscent of old Frankenstein movies. We figured a filter cap shorted first; then, with no fuse to protect them, the transformer and filter choke fried. Of course, immediately following the rifle crack came a sound impossible to describe, but very definitely associated with an extremely distressed wild animal.

We heard several thumps as the animal careened off various closet doors trying for an exit. Finally, as the black smoke started rolling out the door to the hall, Mr. Thompson rocketed out about five feet above the floor level, four sets of claws outstretched and ready to slice to ribbons anything in his way. He never seemed to touch the floor. Maybe he got his purchase off a wall or the banister. In any case, he literally flew over our heads, down the stairs, and out the front door, howling a mixture of fright and defiance all the way.

I never even bothered to price a replacement transformer. I just put in one salvaged from an early '50s television set — so the DX-35 was demoted from a 65-watt to a 50-watt rig, but it continued to give me many enjoyable QSOs. In fact, I still have it, these 42 years later. And, in an illustration of the benefits of adversity, once I had modified the power supply, I felt no hesitation about making other modifications: 160-meter coverage, sidetone oscillator, speech processing, etc. This led to a series of home-brew rigs, and eventually a career in electronics.

As for Mr. Thompson, I guess the ordeal scared him pretty badly. He never came back. Although my thoughts about him in the days immediately after he ruined my transmitter were not so charitable, I often find myself hoping now that he managed to get himself adopted by a retired couple who spent their winters in Florida.

One More Hospital Test

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unused telemetries powered up for this test demonstrated no indication of my transmissions. This suggests that there is no interaction between the telemetries and the FRS radio.

Perhaps higher power, or digital modes, or a different frequency of operation, would have elicited interference to the operation of the monitoring equipment, but this FM, low-power handheld radio did not produce interference in this test.

While my ham colleagues may not employ FRS radios in the course of their community service, the process that I used to address the concerns of the officials of the hospital employing me may be useful to you. You might use this process to reassure the officials of the hospitals that you serve, that you will not interfere with life-safety-critical systems. Similarly, testing in advance of "The Big Day" might reveal RFI issues you ought to resolve, and assist you in effectively serving your community.

Given that experience suggests that when the public telephone network is out of service, so too are the cellular

providers, the likelihood is that amateur radio operators will have the opportunity to provide communications support to the hospitals (among other agencies) in our hometowns. While Y3K may be far enough off in the future that none of us reading this will be around to serve, perhaps the next winter ice storm, spring tornado, summer thunderstorm or autumn hurricane will allow us the opportunity to be of service. Now might be a good time to determine if our equipment will interfere with life safety devices in the hospitals in our towns, or what we need to do to prevent such interference. While we have the leisure time, seems like a good time to do this sort of tinkering. It certainly will allow us to look more professional than jury-rigging the "solution du jour" in the heat of an emergency!

Gold Is Where You Find It!

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with a BFO, maybe a crystal filter, and manufactured by someone like Hallicrafters, National Radio, or Hammarlund! (I'm thinking: There! That ought to straighten him out!)

Bud said: "Yes, I think that is just what you might be able to use. It's a Hallicrafters SX-9 radio in a metal case with large metal dials, a BFO, an S-meter, and, I think, a crystal filter."

I said: "HOLY COW! HOW WRONG CAN A GUY BE? OF COURSE, I WOULD LOVE TO HAVE IT!"

To make a long story short, Bud gave me the radio and it was a beauty. I used it for several years and made many contacts with it. It had great stability, the BFO worked perfectly, and the crystal filter was very sharp. Never again have I made a quick assumption on what I expected a person to know on any subject. Bud had very little technical knowledge of ham radio but he sure knew that he had what I needed in the way of a receiver! (A special thanks also to you, Bud.)

Unfortunately, as time went on, I got the fever for a new Hallicrafters SX-96 CW/SSB receiver. Allied Radio gave me a $50 trade-in allowance for my Hallicrafters SX-9.

I have regretted it ever since!

Calendar Events

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SELLERSVILLE, PA The RH Hill ARC will hold their hamfest at Sellersville Fire House, Rt. 152, 5 miles south of Quakertown and 8 miles north of Montgomeryville, on October 21st. Talk-in on 145.31. VE exams 10 a.m.–1 p.m., all classes. Bring documents. Indoor spaces $12, table included; outdoor $6, bring your own tables. Admission is $5. For more info check the Web site at [www.rfhill.ampr.org], or contact Linda Erdman, *2220 Hill Road, Perkiomenville PA 18074.* Hamfest Hotline (215) 679-5764.

SPECIAL EVENTS, ETC.

SEP 15, 16

BENTON HARBOR, MI Heathkit Educational Systems and the Blossomland ARA will host Special Event Station W8KIT, to celebrate the 75th Anniversary of Heathkit. Operation will be 1400Z-2400Z on September 15–16. Frequencies will be: 7.250, 14.260 and 21.360. Station equipment will be all Heathkit. Send an SASE for QSL card to *W8KIT, c/o Heathkit Educational Systems, 455 Riverview Dr. - Bldg. 2, Benton Harbor MI 49022 USA.*

SEP 22, 23

BERLIN, PA The Somerset County ARC will participate in the celebration of the 8th Annual Berlin Pennsylvania Whiskey Rebellion Days by operating a special event station on the lower 100 kHz of the General class SSB portions of 80m, 40m, 20m; and SSB between 28.3 and 28.4 MHz of the 10m band, for a 24-hour period starting at approximately 12 noon (EST), September 22nd. A certificate will be awarded to contacted stations that send a large SASE with the contact info on their QSL card or paper to the Somerset County ARC, c/o J. Crowley, 135 Baxter Dr., Somerset PA 15501 *USA*. The certificate is 8.5 inches by 11 inches. For more info about the Whiskey Rebellion, go to [http://www.angelfire.com/pa3/berlinpa/whiskeymaster.html].

WANTED
Fun, easy to build projects for publication in 73.
Joyce Sawtelle,
73 Amateur Radio Today,
70 Hancock Road
Peterborough NH 03458.

Hamsats

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Day from the ISS using the call NA1SS. The W2LV Field Day group in New Jersey made their contact with Susan while demonstrating their station to onlookers including a county sheriff and a state congressman.

The AMSAT rules will be changed for 2002 to allow contacts with ISS. In other news from ISS, a new packet terminal node controller (TNC) is scheduled to be sent up to the space station in August. No more NOCALL from space! Expect to see RZ3DZR instead.

Field Day 2002

While there are no guarantees that AO-10 will still be on the air for Field Day next year, there are also no promises about HF propagation. Sunspot Cycle 23 has started its decline. We hope however that both will be in reasonable shape. We are also hoping for a fully commissioned AO-40 to be online for the event. Will you be ready?

Homing In

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they've been, know where they're going and usually know that they want. A lot of them have families and realize that they have to learn in order to earn. Kids are different when it comes to motivation. How do you motivate a kid? I think we've found some great ways.

"On the other hand, a lot of these kids do know the direction they want to go. They may not necessarily want to be an engineer, but they may want to work in the medical field with the new technologies, for instance. Wireless technology is part of that, and they know it."

If you enjoy the benefits of ham radio and high tech, you owe it to the next generation to help jump-start the scientists and engineers of the future. Why not do your part by sharing your passion for your favorite ham radio activity? I hope that it's transmitter hunting, but whatever it is, the kids are waiting. And I'm waiting, too, ready to tell your story in "Homing In"!

On The Go

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choose the proper tool for a particular challenge.

What tools do you choose? Why do you choose a particular mode or frequency for a particular purpose? Have you used a combination in a new or creative way? Why not share your success story or lesson learned? Send your ideas by E-mail, snail mail, carrier pigeon or whatever. With all the activity I hear out there, I'm sure there are some exciting stories to tell!

The Digital Port

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Dave AA6YQ, who developed WinWarbler for PSK31. That is a great program that allows the monitoring of three signals simultaneously and does an excellent job of it.

It seems WinWarbler was merely a release for some stored up energy when you take a look at his other offerings. You will find some interesting freeware-for-thought if you will go to the WinWarbler site listed in The Chart.

Don't be intimidated if you do not own an Icom rig. Though Dave has built an impressive gallery of software that includes automation of the Icom rig, there is much more. You will find logging, DX spotting, path plotting, and propagation. All these are meant to work together for nearly effortless DX ham communication. Quite an impressive array and, after watching comments on the DXLab reflector, I am sure the software is working for its faithful users. Just one more chink filled on the way to a fully digitized hobby courtesy of hams dedicated to the quest.

If you have questions or comments about this column, E-mail me [KB7NO@Worldnet.att.net]. I will gladly share what I know or find a resource for you. For now, 73, Jack KB7NO.

QRH

continued from page 7

And give your Elmer your thanks and a hug
His caring and efforts have come to fruition
By seeing your joy in preserving tradition
Why dedicate this poem? Why did I bother?
You see, my Elmer was also my father
Though all those nostalgic days are gone
I'll always be grateful for what he passed on
His wisdom and patience in this endeavor
Gave me a hobby I'll treasure forever
With this I'll close, I have to go
Dad's calling CQ on the radio!
I've waited all year so I could say
Thank you and Happy Father's Day!"

Author unknown. Thanks to The Communicator, *the monthly newsletter of the Central New Hampshire ARC, July 2001.*

Never say die

continued from page 4

with an emergency-powered ham rig. All other communications will have been wiped out and won't be back for years.

As Alfred E. Newman says, "What, me worry?" Now, leave me alone so I can start building that ark.

Coué

A hundred years ago Émil Coué had millions of people saying, "Every day, in every way, I'm getting better and better." They shouldn't have stopped. If you doubt it, spring $14 for a copy of Barbara Levine's *Your Body Believes Every Word You Say*. [Aslan Publishing, 3356 Coffee Lane, Santa Rosa CA 95403 (1-800-275-2606), ISBN 0-944031-07-2, 203p, 1991, $14 ($2.50 s/h)]. Well, we already know from Stone's *The Secret Life of Your Cells* that every cell in your body is in constant communication with every other cell, even when they have been separated by thousands of miles—so, when we think something, it has an effect on every cell of our bodies.

When you forget something do you comment on how your memory is getting worse? Well, it sure will. When I have trouble remembering something I wait and when it comes to me a few minutes later I congratulate my memory on doing such fine work.

If you've read the *Secret Life of Plants*, you know that plants can sense what we're thinking. If you tell them they are going to be big and beautiful, they will.

The more you talk positively about yourself, the better you're going to be. The more you put yourself down, the worse things will get. So watch your language. None of this so and so giving you a pain in the ass stuff. Do you really want hemorrhoids? Or so and so makes me sick. Hello, flu.

I once knew a beautiful young girl who kept saying she believed she was ugly. You should see the fat, ugly matron she turned into. Her belief sure came true.

On the positive side, many people have survived cancer by visualizing the cancer dissolving and going away. I'd also want to change my diet and not depend totally on positive imagery to save my butt every time.

A New Mode To Pioneer

This could be the answer to the spectrum limitations facing the FCC. How about a communications mode that is instantaneous (not limited by the speed of light), does not use the electromagnetic

spectrum, is interference-free, and works over any distance using almost no power?

In *The Secret Life of Your Cells* (see page 5 of my wisdom book) it's shown that cells taken from a person and kept alive in a nutrient, and then connected to a meter, register exactly the same meter movement as one connected to the cell's host a thousand miles away. No amount of electronic shielding prevents this cell to cell communication.

My next step would be to do this same test using cells from a plant, modulating one set of cells and demodulating the distant cells. Then I'd want to find out what bandwidth this link provides. Will it only work for CW, or can we send TV bandwidth?

Will the TV set of the future have a plant cell in a nutrient solution for each station? I can see the HDTV wide-screen 200 cell TV set of 2020.

Cell phones may be the real thing, with no antenna needed—run by a couple of AA lithium solar-charged batteries.

IQ

In this case I'm referring to Ignorance Quotient. You see, a high Intelligence Quotient is like having a higher powered computer. Which is fine, but only if it has data with which to work.

One of the reasons I write about so many things (which I think should interest you) is to encourage you to think and to read more (non-fiction) books.

About how many non-fiction books have you read in the last year?

Yes, I read some fiction too. Well, most of it Sherry reads to me while I'm driving us places. The latest Kinsey Milhone ("O") is a turkey, but her "A" through "N" books were great. So I'm keeping up with the mischief in Santa Turisa.

The popular concept that one's education is all taken care of by our schools is a myth totally without foundation. Education is a life-long adventure, and an exciting one. That's me out there in front, the guy with all the arrows in his back. Every so often I send back a note (via my editorials) saying, hey, guys, look at what I've found!

The ignorant are busy entertaining themselves with ball games, golf, and seeing how fat they can get before it kills them. As the founder of American Mensa, I've met an awful lot of high IQ "geniuses." What I haven't met are many of these elite who aren't pathetically ignorant.

Amusements

In early December I got a call from a fan in Las Vegas, asking me to send her another copy of my *Secret Guide to Health*. It seems her father, a Mayo Clinic doctor, grabbed hers and took it with him before she had a chance to read it. Her father, it developed, had been King Hussein's doctor, and now was King Abdulla's doctor.

"When will he be back?" I asked. She said he'd be back for the Christmas holidays. Could she arrange a meeting? No problem.

So Sherry and I got airline tickets to Las Vegas, plus a hotel room at Arizona Charlie's East and an Alamo rental car. I then called Art Bell W6OBB and arranged to visit him. Well, I've been wanting to see his ham station and emergency power setup.

Now, have you guessed what got me into action so quickly? The lure of Las Vegas? No way. Been there dozens of times for hamfests, computer, and consumer electronic shows—and I don't gamble. No, my goal was to get an introduction to visit King Abdulla. I'd like to talk to him about making major changes in Jordan's agriculture, schools, and health care.

If you've been reading my essays you know what I mean. I believe I can help Jordan easily double or triple its agriculture, and at much lower cost. Plus, the resulting fruits and vegetables would be far healthier to eat. I can show Jordan how to cut its school costs, while enormously improving their children's education—making Jordan an educational center for the entire Arab world.

And if I can get the government to encourage the Jordanian people to stop poisoning themselves, they could have the best health in the world.

In each of these fields I'd like to have a test case to show what can be done. It was worth a trip to Las Vegas.

Thirty years ago, when I heard that King Hussein's wife had gotten him a ham rig for Christmas, I sent him a cable asking if he'd like someone to show him how to use it. He cabled back saying sure. A couple days later I landed at Amman, where I spent two weeks making thousands of contacts, with His Majesty staying up all night with me, having a ball.

After talking with his Minister of Communications and Minister of Education, I explained to His Majesty that if he would put ham club stations into the schools and provide a teacher to go around teaching the fundamentals of electricity and radio, that instead of having to pay technicians from Germany, Sweden and Switzerland several hundred dollars a day to install telephones and electrical equipment, this could be done by Jordanians at a fraction of the cost.

He liked the idea and had me explain it to his government leaders at a special meeting the next day. I promised to write a set of ham rules and regulations for them. Done deal.

A few days later, after I'd returned home, the Palestinians tried to kill His Majesty and a civil war erupted, with the TV news showing the hotel where I'd stayed being strafed and bombed. Close call.

Three years later, while I was swapping slow scan photos with a ham in Athens, JY1 broke in and asked me to meet him in Washington during his coming visit. I met him at Blair House, presenting him with a Drake 2m FM rig to use during his visit. He handed me an envelope with first class round trip tickets to Amman saying, "I want you to come over and see what you've done."

When I arrived I was met at the airport by Hisham Ansari, the chap who had been going around to the new ham clubs, teaching the children the fundamentals of radio and electronics. He drove me from one end of Jordan to the other, from Irbid in the north to Aqaba in the south, visiting the schools and youth clubs and talking with over 400 newly licensed and excited young hams. Both boys and girls.

On my last visit to Jordan, again as a guest of His Majesty, Prince Raad JY2RZ arranged a meeting of the Royal Jordanian Amateur Radio Society, where he introduced me as the man who had had more of an influence on Jordan than anyone but the King.

I hope that, in a few years, I can hear that said again, as a result of changes I can help introduce in their health, education and agriculture.

Las Vegas

There's nothing else on Earth that even comes close to Las Vegas. It is the entertainment capital of the world.

And that got me to thinking—and I don't think you're going to like my thoughts. The Roman Empire was destroyed while the Roman people were being distracted by the games. I've been reporting in my essays what's happened to our schools, the trillion and a half dollar medical industry scam, the phony drug war, the war on poverty that's increased black illegitimacy from around 3% to 70% over the last 30 years, the billions wasted on scientific welfare such as hot fusion and the linear accelerator. And that stupid space station.

In the meanwhile almost everyone has been distracted by spectator sports, hundreds of TV channels, Oprah, Judge Judy, rock music and junk novels.

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Things Are Looking Up

My calculations for September show a steady decline in solar activity, a possible indication that we have passed the peak of Sunspot Cycle 23. It is more likely that we have reached a lull between peaks, but for this month we ought to at least see fewer disruptions as older sunspots fade away and less new ones appear.

This, coupled with a seasonal improvement in propagation conditions, should bring a noticeable upswing in DX opportunities across the HF radio spectrum. For the first time in a long while the calendar shows more good (G) days than poor (P) and fair-to-poor (FP) ones combined!

The worst period is likely to fall at the beginning of the month, with a minor geomagnetic storm possible. Other "suspect" days include the 9th–10th, 15th–16th, but as of this writing (June) none seem likely to produce strong or long-lasting disruptions. The very best periods for above average DXing appear to be the 12th–14th and 28th–30th, with the 4th–5th and 18th–19th running a close second.

Band by Band Summary

10 and 12 meters

Expect DX to improve throughout the month with regular paths to Europe before noon and to Africa after noon. South America and the Pacific should open up later in the afternoon with the Far East appearing before sundown. Short skip from 1,000 to 2,000 miles is anticipated on most days.

15 and 17 meters

The southern hemisphere is your best bet, but excellent daytime opportunities exist for most areas of the globe. Try Europe or the Middle East before noon and other areas after noon. Daytime short skip beyond 1,000 miles is expected.

September 2001						
SUN	MON	TUE	WED	THU	FRI	SAT
						1 P
2 P	3 F	4 F-G	5 G	6 F-P	7 F	8 G
9 F-P	10 F-P	11 F-G	12 G	13 G	14 G	15 F-P
16 F-P	17 F-G	18 G	19 G	20 F-P	21 G	22 F
23 F-P	24 F	25 F-P	26 F-P	27 F-G	28 G	29 G
30 G						

EASTERN UNITED STATES TO:												
GMT	00	02	04	06	08	10	12	14	16	18	20	22
Central America	15/17	17/20	17/20	17/20	17/20	15/17	15/17	10/12	10/12	10/12	17/20	10/12
South America	15/17	15/17	20	30/40	30/40			10/12			12/15	12/15
Western Europe	30/40	30/40	17/20	17/20				10/12	10/12	12/15	17/20	17/20
South Africa	20/30	40	20/30	20/30					10/12	10/12	12/15	12/15
Eastern Europe	17/20	30/40	40/80	40/80	30/40			15/17	10/12	15/17	15/17	17/20
Middle East	20	20	20						10/12	10/17	15/17	15/20
India/ Pakistan	17/20	17/20						15/17				
Far East/ Japan	10/12		17/20				17/20	17/20			15/17	10/12
Southeast Asia	15/17		17/20	17/20			17/20	15/17	10/12			15/17
Australia	10/12	17/20	20	20	20	30/40	30/40	17/20				10/12
Alaska	10/12		20				17/20	20			15/17	10/12
Hawaii	10/12	12/15	17/20	17/20	20/30	20/30	17/20	17/20				10/12
Western USA	20/30	20/30	20/30	30/40	30/40			10/12	10/12	10/12	15/17	17/20
CENTRAL UNITED STATES TO:												
Central America	15/17	15/17	17/20	17/20	20/30			10/12	15/17	10/12	10/12	10/12
South America	15/17	15/17	20/30	20/30	17/20			10/12			10/12	12/15
Western Europe								12/15	12/15	12/15	17/20	17/20
South Africa			17/20	17/20					12/15	12/15	15/17	17/20
Eastern Europe	30/40	30/40	30/40						12/15	12/15	17/20	17/20
Middle East	20	20							15/17	15/17	15/17	
India/ Pakistan	15/17	17/20						12/15	12/15			
Far East/ Japan	10/12	12/15	17/20	17/20	17/20		17/20	17/20				10/12
Southeast Asia	10/12		15/20	17/20					10/12	10/12		
Australia	10/12	15/17	15/17		17/20	20/30	30/40	17/20			12/15	10/12
Alaska	10/12	12/15	17/20	17/20	20		17/20	17/20				10/12
Hawaii	12/15	15/17	15/17	17/20	17/20	20/30	30/40	17/20		10/12	12/15	12/15
WESTERN UNITED STATES TO:												
Central America	10/12	12/15	15/17	17/20	30/40				10/12	10/12	10/12	12/15
South America	10/12	12/15	15/17	17/20	17/20						10/12	10/12
Western Europe	17/20				17/20			17/20	17/20	20	20	20
South Africa	17/20	20		20						10/12	12/15	12/15
Eastern Europe	17/20	17/20							15/17	15/17	17/20	17/20
Middle East	20									15/17	15/17	20
India/ Pakistan		15/17	17/20						12/15	15/17		
Far East/ Japan	10/12	10/12	12/15	17/20	17/20	17/20			17/20			15/17
Southeast Asia	10/12	10/12						17/20	15/17	17/20		
Australia	10/12	12/15	15/17	15/17	17/20	17/20	17/20		17/20			
Alaska	10/12	10/12	15/17	17/20	17/20	17/20		17/20	17/20			15/17
Hawaii	10/12	10/12	12/15	15/17	20/30	20/30	30/40		12/15	10/12		
Eastern USA	20/30	20/30	30/40	30/40	30/40			10/12	12/15	12/15	15/17	17/20

Table 1. Band, time, country chart. Plain numerals indicate bands which should be workable on Fair to Good (F-G) and Good (G) days. Numbers in parentheses indicate bands usually workable on Good (G) days only. Dual numbers indicate that the intervening bands should also be usable. When one number appears in parentheses, that end of the range will probably be open on Good (G) days only.

20 meters

DX openings to most parts of the globe can be worked on good (G) days. From around sunrise until several hours past sunset. Peak conditions will usually occur an hour or two after sunrise and again in the late afternoon. Short skip will extend from 500 to 2,000 miles during the day, and from 1,500 to 2,000 miles after dark.

30 and 40 meters

From local sunset until sunrise this may be the place to be, especially to the southern hemisphere. Average skip during the day is about 1,000 miles, but at night the distance can vary between 500 and 2,000 miles.

80 and 160 meters

World wide DX will begin to open up as the equinox approaches, although static from thunderstorms will often mask signals. Nighttime short skip will average between 1,000 and 2,000 miles.

NEVER SAY DIE

continued from page 59

Oh, I almost forgot that band of crooks we support in Washington. The ones who are taking our money and spending it for us on all this crap.

After inflation has been factored in, the purchasing power of a working couple in 1995 was only eight percent better than that of a single working man in 1905. This has forced both parents to work, leaving children to day care centers and nursery schools instead of a home and mother.

The promise was that schooling was the cure for unevenly spread wealth, it's been the reverse, with wealth 250% more concentrated at the end of the century than its beginning.

Like prototypical American Homer Simpson, most of us are far more interested in watching ball games than in helping our children to grow and learn.

And Las Vegas is the epitome of entertainment.

Ham Radio, Too

Our hobby provides plenty of opportunities for us to learn about new technologies. But what percentage of hams have gone to the trouble of making any satellite contacts? Or been involved with RTTY, slow scan, or anything other than rag chewing or chasing DX? Or contests?

My first ham contact was with a 2-1/2 meter transceiver I built myself from an article in *Radio*. It had a 1G4GT superregenerative receiver and a modulated oscillator transmitter (1Q5GT), and it worked great. After WWII, when we were first allowed back on the air, 2-1/2 meters was the first band they opened and I was on immediately with my walkie-talkie rig from the Submarine Base in New London CT, where I was teaching electronics.

When they opened 10m I quickly got on with another home-built rig running a pair of 813s in the final.

When narrow band FM was developed I was one of the first on with it. By 1949 I was active on RTTY and had helped put up a repeater. Then came SSB, with me quickly building an exciter for that new mode. Then slow scan, ham satellites, and repeaters. I helped pioneer all of 'em, and I had the time of my life, learning every inch of the way.

Our hobby provides plenty of opportunities to experiment and learn new things. Or you can sit and rag chew night after night, or join the DX pileups. Or make meaningless short contacts by the gross. Yeah, I did all of those. For a while. Got over it. It was even fun operating from rare countries like Nepal, making ten-second contacts by the thousands. Got over that too. And I had a great time making contacts with seven states on 10 GHz with a tenth watt rig. Then there was my 2m station on the highest mountain in southern New Hampshire running a kW and a 336-element beam. What a thrill to hear my signal coming back from a ham satellite, and working guys all over Europe and into South America. I learned a lot and have had more fun than should be legal.

How about you?

The Bottom Line

A National Adult Literacy Survey in 1993 showed that 42 million Americans over the age of 16 can't read. 50 million can recognize words at the 4th and 5th grade level, but cannot write simple messages. 3.5 percent reached the reading level 30 percent did in 1940, and which 30 percent do in other developed countries today. 96.5 percent of Americans are mediocre to illiterate. Say, why am I bothering to write books if so few people can read 'em?

It's no wonder, too, that almost all of today's magazines waste huge amounts of space on large, irrelevant illustrations. They're picture books.

Our schools have done this to us, with the complicity of the government.

Which is why I'd like to use Jordan as an example of what a school system can do—enough to drop everything and fly to Las Vegas to follow up on serendipity.

Yes, I enjoyed seeing the New York City building, Venice and so on. No, I didn't drop a nickel in a slot machine, but I sure did enjoy the lavish, inexpensive buffets.

How It Works

In a world where almost nothing is as it is made to appear, it should not surprise you to learn that lobbyists are paying off our senators and representatives with cash, trips to "conferences" in prime vacation areas and so on. And that the same thing is going on in the medical field, where the drug companies are lavishing attention of doctors. I'm talking $900 dinners at the fanciest of restaurants, trips to exotic places for an hour or so "conference," and so on.

Yes, of course the drug companies keep track of how this influences each doctor's prescription record. Is he pushing more Zoloft or Paxil on his patients?

All of the pressure and "information" have to do with prescribing drugs. That's where the money is. That's where *your* money is going.

The fact that *any* illness can be cured without drugs is something doctors never hear about. There's no one to tell them. No one to pay them to hear about it. And since it would put them out of business in short order, it's something they don't *want* to hear. It's their worst nightmare. There's just Dr. Lorraine Day in San Francisco, Dr. Bruno Comby in Paris, and Wayne Green up here in New Hampshire preaching to empty pews.

Hey, don't believe a word I write, but at least download Barbara Simpson's interview of Dr. Day by going to [www.artbell.com] archives, July 10th, 2001 program, starting with the second hour of the show. Dr. Day explains how cancer, AIDS, and so on are totally curable by anyone, and without any drugs. She is living proof!

The Different Drum

Since I write some seemingly preposterous things it's easy just to dismiss me as crazy. As a conspiracy nut. And so on. That's the easy way out. That doesn't take any thinking.

The fact is that, despite my advanced age, my mind is still working pretty well, and I don't (and haven't in the past) written about something in my editorials where I haven't done my homework.

So I'm able to get up in front of a couple thousand professional educators and lecture them on what's wrong with our school system, what can be done to improve it, and where the whole field is heading over the next twenty years. It takes some guts to tell a couple thousand teachers that they've all been bamboozled

— led by the educational unions just like a toreador leads a bull with a waving red flag — and to convince them it's true.

I'm reminded of the radio talk show host who said. "I believe we went to the Moon and I don't want to hear anything more about it."

So here's Wayne, telling teachers they have been duped. Telling doctors they, too, have been duped — big time. And telling anyone who will listen that very little that they've been taught to believe is really true. Sure, I have good solid references to back up everything I say, but for the most part I'm preaching to deaf ears, backed up by blind eyes.

These days we tend to roll our eyes and ignore nut cases rather than crucifying them. That's some progress for which I'm thankful.

Club Newsletters

With used Macintoshes selling in the $200 range, and excellent printers available for $50, the cost of producing a ham club newsletter is no longer a factor. If you want to include photographs, even the price of brand new scanners has plummeted. Last year's scanners? They're probably giving 'em away by now.

I prefer the Macs because they're so easy to learn and use. I prefer PageMaker software for my books. Heck, that's what we're using to produce *73* every month!

A club newsletter, if it's interesting, can substantially boost meeting attendance and the turnouts for club activities like Field Day.

Aha, "interesting." That's the key. When you get *QST* what do you turn to first? Your section activities? If you get *CQ*, what do you turn to first there? Contest results? I know what you turn to first when *73* arrives. It isn't my ham oriented writing that does it, it's stuff like my research into milk, where I explain that if you are feeding your family milk you are enormously increasing their potential for breast or colon cancer — unless you're paying a lot extra to make sure the milk you're buying doesn't contain bovine growth hormone and is laced with the antibiotics farmers have to feed their cows to counter the mastitis and hoof problems the growth hormone causes.

Well, I've got a patent on ham-irrelevant editorial essays, so what can you do to make sure the club members open the newsletter the minute it arrives? How about drumming up enthusiasm for a coming club event? Or an in-depth report on one just past?

How about the latest fun that club members pursuing special ham interests are having. What new countries have your DXers snagged? Maybe scan in the QSL card. What's doing on six meters? The band is going crazy, so those up there are having the time of their lives. Anything new with the local repeaters? How about any members active on our ham satellites? RTTY? Slow scan? Packet?

What's on the Internet that the members will find of interest? Are there any upcoming hamfests within driving distance? Have any members attended a hamfest recently? How much fun was it? What were the highlights? What did those who went to Dayton think of it this year?

Oh, has any club member bought a new piece of ham gear or put up a new antenna? Get the story! How about any members operating HF mobile — what have they been working?

What's going to be special about the next club meeting? Will there be a talk via a telephone hookup and an amplifier by a manufacturer or some ham luminary?

You get the picture.

One more thing — I'm going to be very disappointed if I'm not on your mailing list. Or, if you distribute it via E-mail, that a copy doesn't go to [w2nsd@aol.com].

Now, get hot!

Killing Wayne

At 14, when I was walking to school one day, I managed to catch a finger on a nail sticking out of a short fence post. It made a gash over a half inch long and there was blood all over the place. The school nurse wrapped it up and sent me home. My folks were out, so my grandmother took me to a doctor across the street who sewed up the cut. And, just in case, he gave me an anti-tetanus shot.

Minutes after when we got back home I collapsed and was in a coma for several days. It turned out I was allergic to the shot, which was made from horses. Like my father, I was allergic to almost all animals. The doctor apologized for not testing the serum first on my arm and said that another shot like that would probably kill me.

By the time I joined the Navy in 1942 there was a new anti-tetanus serum, one not made from animals, so when I got my obligatory Navy vaccinations I made sure it was the safe stuff.

Three years later it was time for booster shots. I reported into sick bay and again explained about my allergy. The doctor assured me that there was no problem, but I insisted on his testing it on my arm first. He shot a tiny bit into my forearm and said to come back in a half hour.

When I came back my arm was fine. No redness, no swelling. But the vaccine had been put back in the refrigerator for lunch, so the doctor said to come back after lunch.

I did. By then my arm had swollen several inches and I could no longer bend my elbow.

I came that close to death.

Now I find that there have been only a few cases of tetanus in the U.S. — ever. This whole lockjaw thing is a pharmaceutical scam to sell useless vaccinations. And always has been.

Our Schools

Have you ever wondered why our public school system is so bad, and why it's getting worse? As usual, just follow the money.

The teacher unions, which have well-healed lobbyists in Washington and every state capitol, have a huge vested interest in things not changing (except for the government spending more money), and they're willing to pay whatever it takes to make sure nothing changes.

Then there's the government. It's run by three groups — congress, the administration, and the bureaucrats who do 99.9% of what little actual work is done, and who continue in power while congress and administrations change. None of these groups see any benefit to them in a better educated citizenry. They have a huge vested interest in the people being manipulated by the media, and being sheep.

Then there's big business. They need dumbed down workers, not creative trouble-makers. They're getting exactly the kind of workers they want from the present system.

About the only constituency for better schools are the few parents who care one way of the other. They're unorganized, so they're ignored.

School administrators oppose change. Teachers oppose change. The government opposes change. Business opposes change.

Is the situation hopeless? Of course not. But there's no point in marching around demonstrating for better schools or bitching about it. Waste of time. Then, what's the answer?

You don't win wars by attacking the enemy head on. You attack from an unexpected flank. This is why I've been writing about the need for replacing our schools with truly first rate education delivered via DVDs. Technology can eventually make public schools irrelevant, just as cars obsoleted horses.

The teacher unions keep hammering on the need to spend more money. Well, we have. Currently the tab is $389 billion a year. That's with a "B." We've

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Wise Up!

Here are some of my books which can change your life (if you'll let 'em). If the idea of being healthy, wealthy and wise interests you, start reading. Yes, you can be all that, but only when you know the secrets which I've spent a lifetime uncovering.

......Wayne

The Secret Guide to Health: Yes, there really is a secret to regaining your health and adding 30 to 60 years of healthy living to your life. The answer is simple, but it means making some serious lifestyle changes. Will you be skiing the slopes of Aspen with me when you're 90 or doddering around a nursing home? Or pushing up daisies? No, I'm not selling any health products, but I can help you cure yourself of cancer, heart trouble, or any other illness. Get this new, 2001 expanded edition (156p). $10 (#05)

The Secret Guide to Wealth: Just as with health, you'll find that you have been brainwashed by "the system" into a pattern of life that will keep you from ever making much money and having the freedom to travel and do what you want. I explain how anyone can get a dream job with no college, no résumé, and even without any experience. I explain how you can get someone to happily pay you to learn what you need to know to start your own business. $5 (#03)

The Secret Guide to Wisdom: This is a review of around a hundred books that will boggle your mind and help you change your life. No, I don't sell these books. They're on a wide range of subjects and will help to make you a very interesting person. Wait'll you see some of the gems you've missed reading. You'll have plenty of fascinating stuff to talk about on the air. $5 (#02)

The Bioelectrifier Handbook: This explains how to build or buy ($155) a little electrical gadget that can help clean your blood of any virus, microbe, parasite, fungus or yeast. The process was discovered by scientists at the Albert Einstein College of Medicine, quickly patented, and hushed up. It's curing AIDS, hepatitis C, and a bunch of other serious illnesses. It's working miracles! The circuit can be built for under $20 from the instructions in the book. $10 (#01)

My WWII Submarine Adventures: Yes, I spent from 1943-1945 on a submarine, right in the middle of the war with Japan. We almost got sunk several times, and twice I was in the right place at the right time to save the boat. What's it really like to be depth charged? And what's the daily life aboard a submarine like? How about the Amelia Earhart inside story?If you're near Mobile, please visit the Drum. $5 (#10)

Wayne's Caribbean Adventures: My super budget travel stories – where I visit the hams and scuba dive most of the islands of the Caribbean. You'll love the special Liat fare which let me visit 11 countries in 21 days, diving all but one of the islands, Guadeloupe, where the hams kept me too busy with parties. $5 (#12)

Cold Fusion Overview: This is both a brief history of cold fusion, which I predict will be one of the largest industries in the world in the 21st century, plus a simple explanation of how and why it works. This new field is going to generate a whole new bunch of billionaires, just as the personal computer industry did. $5 (#20)

Cold Fusion Journal: They laughed when I predicted the PC industry growth in 1975. PCs are now the third largest industry in the world. The cold fusion ground floor is still wide open, but then that might mean giving up watching ball games. Sample: $10 (#22).

Julian Schwinger: A Nobel laureate's talk about cold fusion—confirming its validity. $2 (#24)

Improving State Government: Here are 24 ways that state governments can cut expenses enormously, while providing far better service. I explain how any government bureau or department can be gotten to cut it's expenses by at least 50% in three years and do it cooperatively and enthusiastically. I explain how, by applying a new technology, the state can make it possible to provide all needed services without having to levy *any* taxes at all! Read the book, run for your legislature, and let's get busy making this country work like its founders wanted it to. Don't leave this for "someone else" to do. $5 (#30)

Mankind's Extinction Predictions: If any one of the experts who have written books predicting a soon-to-come catastrophe which will virtually wipe most of us out are right, we're in trouble. In this book I explain about the various disaster scenarios, like Nostradamus, who says the poles will soon shift (as they have several times in the past), wiping out 97% of mankind. Okay, so he's made a long string of past lucky guesses. The worst part of these predictions is the accuracy record of some of the experts. Will it be a pole shift, a new ice age, a massive solar flare, a comet or asteroid, a bioterrorist attack? I'm getting ready, how about you? $5 (#31)

Moondoggle: After reading René's book, *NASA Mooned America*, I read everything I could find on our Moon landings. I watched the NASA videos, looked carefully at the photos, read the astronaut's biographies, and talked with some readers who worked for NASA. This book cites 45 good reasons I believe the whole Apollo program had to have been faked. $5 (#32)

Classical Music Guide: A list of 100 CDs which will provide you with an outstanding collection of the finest classical music ever written. This is what you need to help you reduce stress. Classical music also raises youngster's IQs, helps plants grow faster, and will make you healthier. Just wait'll you hear some of Gotschalk's fabulous music! $5 (#33)

The Radar Coverup: Is police radar dangerous? Ross Adey K6UI, a world authority, confirms the dangers of radio and magnetic fields, including our HTs and cell phones. $3 (#34)

Three Gatto Talks: A prize-winning teacher explains what's wrong with American schools and why our kids are not being educated. Why are Swedish youngsters, who start school at 7 years of age, leaving our kids in the dust? Our kids are intentionally being dumbed down by our school system — the least effective and most expensive in the world. $5 (#35)

Aspartame: a.k.a. NutraSweet, the stuff in diet drinks, etc., can cause all kinds of serious health problems. Multiple sclerosis, for one. Read all about it. two pamphlets for a buck. (#38)

$1 Million Sales Video: The secret of how you can generate an extra million dollars in sales just by using PR. This will be one of the best investments you or your business will ever make. $40 (#52)

Reprints of My Editorials from *73*. Very few things in this world are as we've been taught, and as they appear. I blow the whistle on the scams around us, such as the health care, our school system, our money, the drug war, a college education, sugar, the food giants, our unhealthy food, fluorides, EMFs, NutraSweet, etc.

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1997 Editorials: 148 fun-packed pages. 216 editorials. $10 (#74)

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2000 Editorials: 76 pages (thinner magazine as a result of our slowly dying hobby). $5 (#77)

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NH Reform Party Keynote Speech. It wow'd 'em when I laid out plans for NH in 2020, with much better, yet lower cost schools, zero state taxes, far better health care, a more responsive state government, etc. $1 (#85)

Stuff I didn't write, but you need:

NASA Mooned America: René makes an air-tight case that NASA faked the Moon landings. This book will convince even you. $30 (#90)

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Dark Moon: 568 pages of carefully researched proof that the Apollo Moon landings were a hoax—a capping blow for René's skeptics. $35 (#92)

Dark Moon Video: 222-minute exposé nailing NASA with their own photos. If you've watched the NASA films of the astronauts walking on the Moon you wondered at their weird gait. Wait 'll you see it speeded up. It looks exactly like they're running on Earth! They catch NASA in dozens of giveaways that the photos and films had to have been faked. $46 (#93)

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The *73* Flea Market, Barter 'n' Buy, costs you peanuts (almost)— comes to 35 cents a word for individual (noncommercial!) ads and $1.00 a word for commercial ads. Don't plan on telling a long story. Use abbreviations, cram it in. But be honest. There are plenty of hams who love to fix things, so if it doesn't work, say so.
Make your list, count the words, including your call, address and phone number. Include a check or your credit card number and expiration. If you're placing a commercial ad, include an additional phone number, separate from your ad.
This is a monthly magazine, not a daily newspaper, so figure a couple months before the action starts; then be prepared. If you get too many calls, you priced it low. If you don't get many calls, too high.
So get busy. Blow the dust off, check everything out, make sure it still works right and maybe you can help make a ham newcomer or retired old timer happy with that rig you're not using now. Or you might get busy on your computer and put together a list of small gear/parts to send to those interested?

Send your ads and payment to: *73 Magazine*, Barter 'n' Buy, 70 Hancock Rd., Peterborough NH 03458 and get set for the phone calls. The deadline for the November 2001 classified ad section is September 10, 2001.

Never Say Die

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increased spending by 72% in the last ten years in constant dollars, yet SAT scores have been steadily dropping. The spending per student in constant inflation-corrected dollars has gone from $3,367 in 1970 to $6,584 in 2000. The number of students per teacher has dropped from 22 to 17, and yet our kids are learning less and less.

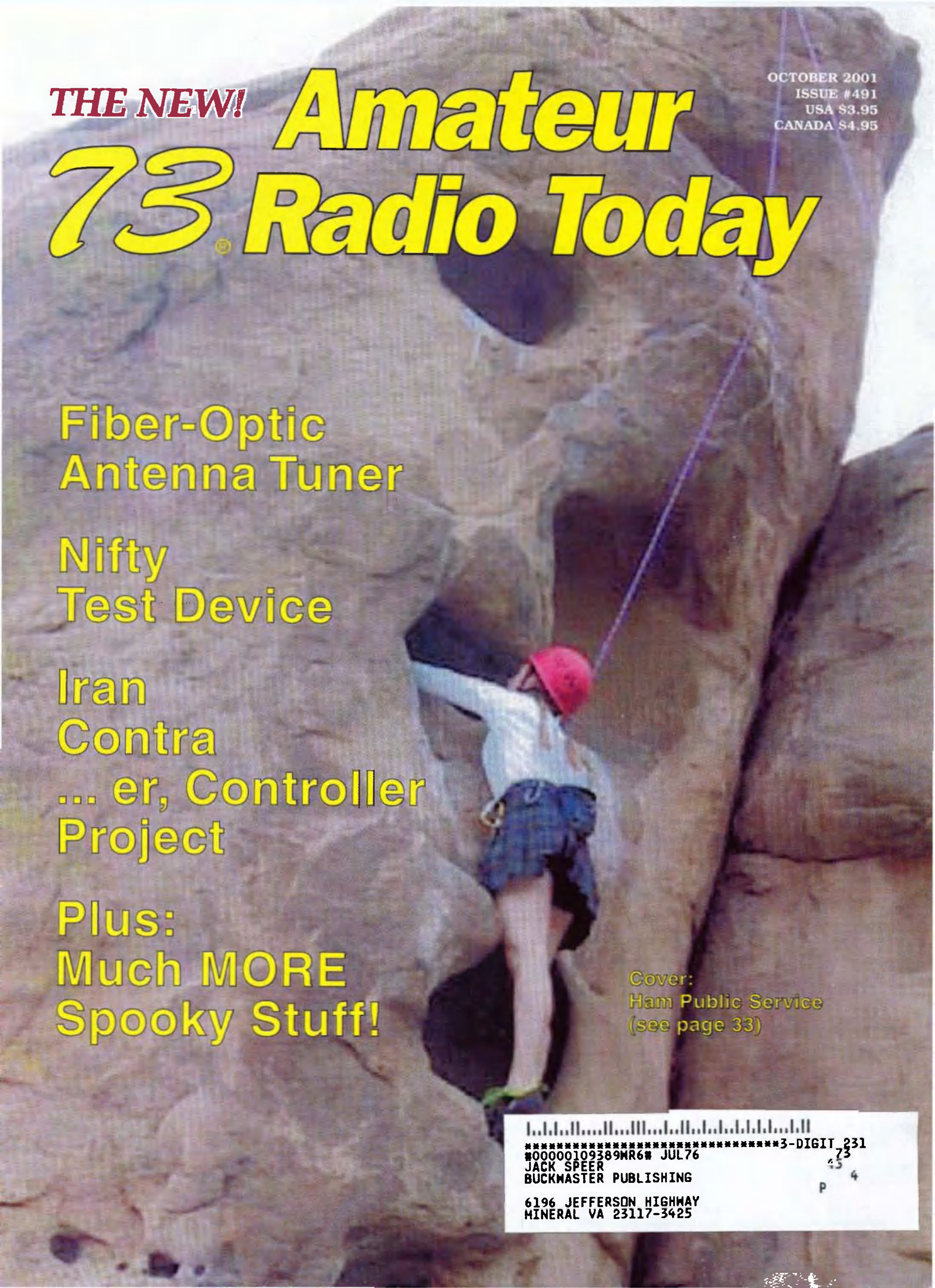
The National Research Council found no improvement in student achievement resulting from greater funding or smaller classes. The U.S. Department of Education found last year that 68% of the fourth grade students could not read at a proficient level. Ditto math.

You can't blame the kids, not when there are some schools out there that are actually educating them. For instance? Like New York's Frederick Douglass Academy, where 79% of the students are black, 19% Hispanic, and one percent white or Asian. In 1998 93% of their students passed the U.S. History Regents, and 88% passed the English and pre-calculus exams. 95% passed the Global History Regents, where citywide only 54% passed.

The Heritage Foundation recently published the Carter Report, which cited 21 High Performing Poverty Schools, so it can be done.

THE NEW! 73 Amateur Radio Today

OCTOBER 2001
ISSUE #491
USA $3.95
CANADA $4.95



Fiber-Optic Antenna Tuner

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Iran Contra ... er, Controller Project

Plus: Much MORE Spooky Stuff!

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OCTOBER 2001
ISSUE #491

THE NEW!

73 Amateur Radio Today

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QRX . . .

More Hams Upgrade, But Little New Blood

A lot of hams are upgrading, but there are few new people coming into the hobby. That's the bottom line as we passed the halfway point in the year 2001.

According to a person who should know, in the last four years the United States Amateur Radio Service has grown at a rate of only 2000 additional hams annually. That's about three tenths of one percent per year and less than the United States Census

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Wise Up & Beat the Odds

NEVER SAY DIE

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Stagnant

It's no wonder the ham industry is in such deep trouble. Do you know how much growth we've had in the last four years? What would you guess, 5%? 2%? No, it's zero percent. Dead in the water. And that's only if we don't count the number of old timers who have died since their last ten year license renewal. Considering that almost half of the ARRL members are retired, and that almost zero percent of older people are truly healthy, we've been seeing a net drop in our numbers.

Either you somehow get the League HQ off the Newington golf courses to start promoting amateur radio to youngsters or we're dead meat.

When I got interested in hamming the average ham age was 28. It was a young man's hobby with all kinds of interesting things to build and pioneer. That's what got to me, not sitting there year after year in a roundtable. And not spending decades fighting the pileups for twenty-second DX contacts. Oh, I did those for a while and had fun doing them. I enjoyed the sweepstakes, DX and VHF contests — for a while. But you have to be a Big Gun to do that, with a kilowatt, tower, and great big beam.

A couple of readers sent me clippings of nice ham newspaper articles — the first I've seen in ages. I should be getting dozens a week, not four or five a year. I should be seeing frequent exciting articles in teenage magazines about our hobby.

The League has the money and the responsibility — what they don't have are enough members who give a damn. If you'll read the latest board of director's meeting report you won't even find a hint of any push to get HQ to start promoting the hobby. I can hear the Newington snoring all the way to New Hampshire.

Teaching

If you want to teach your dog the basics ... to walk by your side, to sit down, lay down, come when called, and then on to tricks, how far do you think you'll get if you punish your dog and make him fear you to force him obey? The only way you'll get any results with a stick is by throwing it. Dogs, until punished, are anxious to please. The more love you put into a dog, the more love you'll get back.

Lion tamers today sleep and play with their lions. They don't go at them with a whip and a chair poked in their face. Siegfried and Roy sleep and play with their tigers. No fear or punishment was involved in their training, only love and understanding.

A University of New Hampshire study showed clearly the connection between teen suicide and parents who spanked their children to force them to behave.

Punishment as a way to teach animals or children just doesn't work.

During my 16 years in public schools and college I had only two teachers who did not use fear and punishment to force me to learn. One in high school, and one in college.

Fear? The fear of not passing a test. Fear of not getting a good grade. Fear of my parents if I didn't get good grades.

Mr. Docket, my high school art teacher, had no tests for me to fear. He loved his subject and communicated this to me. He made learning to draw and paint fun and exciting. My mother, who went to the same high school when she was a teenager, also had Mr. Docket as her art teacher. He got her so excited about art that she went on to Pratt Institute of Art and became a commercial artist, painting magazine covers and portraits.

In college it was memorize and test, memorize and test. None of us stayed up all night studying because we wanted to learn more, we did it so we could pass another damned test the next day. The punishment was brutal and the college was proud of it.

The teachers made no effort to make their subjects interesting or fun. I took three years of calculus and hated every minuet of it. When I asked the teachers where I might have a use for what we were being forced to memorize, they had no answer. No wonder, I've been in all sorts of businesses and published high-tech magazines for most of my life and I've never had any occasion to use anything covered during that four years of torture.

The English literature course, which should have been real fun, was an unforgettable grind which turned me off to reading for years.

During the four years of college torture at Rensselaer I had one course where the professor made it fun to learn. He made it so much fun that all of us hated it when the class was over and could hardly wait to get to our homework. We had no exams to fear. We had problems to solve and the excitement of solving them. It was great fun. The subject? Probably the most unlikely to seem fun that you could imagine: accounting!

This is why I predict that education provided on DVD via interactive video is going to eventually wipe out our present school system. Imagine kids begging their parents to get them a program on U.S. history, or geometry! When we provide educational programs that are fun and exciting, we won't be able to stop kids from learning any longer. The history of how America got started is a fantastic story.

Everything that our school system is supposedly teaching can be taught in a fraction of the time if the kids are having fun doing it. Reading, writing and arithmetic can be learned in less than 100 hours instead of twelve years.

When I joined the navy during WWII as an electronic technician, I didn't know beans. The navy school, in just nine months, taught thousands of kids who didn't know a volt from an ampere when they started, how to

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Bureau's total projected percentage increase in the total population of the country.

The person presenting the facts is Fred Maia W5YI, who heads up the W5YI VEC and has been carefully evaluating trends in ham radio for over two decades. And what he has found is good reason for concern.

According to Maia, four years ago, the total Amateur census stood at 674,000. It now stands at 682,000. But, says Maia, an additional 30,000 amateurs are still listed in the FCC's database which includes those whose licenses have expired, but who fall within the government's 2-year renewal grace period. That's the time when you cannot operate a station but can renew without taking an exam.

Maia says that the FCC is now canceling about 1,500 licenses every month that are not renewed within that grace period. He suspects that many are silent keys.

The good news — if you can call it that — is that hams upgraded their licenses in unprecedented numbers. Maia believes that this was motivated by the FCC's restructuring of the United States Amateur Radio service. With the reduction of the top Morse testing speed to 5 words per minute, he believes that most Technician Pluses, Generals, and Advanceds upgraded simply because the 13- and 20-word-per-minute code exams were no longer required. As a result, and to the delight of equipment suppliers, tens of thousands of potential high frequency operators have been added to the all-band rolls. By license class, that's 20,000 new Extra Class and 27,000 added Generals.

But there is another side to the equation. As you might expect, the Novice, Technician Plus, and Advanced Class — all of which have essentially been placed in limbo since restructuring — have seen comparable decreases in numbers. Advanced is down by about 15,000. The Tech Plus is down by 40,000, and there are 8,000 fewer Novices.

The Tech Plus got a double-barrel hit because this license class is no longer being issued. Instead, the database of Technician Plus and Technician class have been lumped together in the FCC's database. Existing Tech Plus license holders are having their tickets renewed as Technician even though they hold a 5-word-per-minute code credit.

This, says Maia, distorts the total of No-Code Technician-Class statistics since many Technician class holders do indeed hold Morse Code credit.

There is some good news. Statistics show that about 1,600 new code-free Technician Class hams are licensed for the first time each month. That's close to 19,000 annually.

Thanks to David Black KB4KCH and the W5YI Report, *via* Newsline, *Bill Pasternak WA6ITF, editor.*

Young Ham of the Year

Patrick Clark KC8BFD, a 17-year-old from Elkview WV who is heavily involved in public service, emergency communications, and youth recruitment of new radio amateurs, has been named the 2001 "Amateur Radio *Newsline* Young Ham of the Year" (YHOTY), according to ham radio operator and Award Administrator Bill Pasternak WA6ITF. The award is jointly sponsored by Pasternak's Los Angeles-based Amateur Radio *Newsline*, Vertex Standard USA, Inc., of Cerritos CA, and CQ Magazine.

Licensed since age 10, Patrick comes from an all-ham family. His sister Erin is KC8PZZ. Mother Tina is N8TSY and his dad is Jeff Clark K8JAC. Following in his family's footsteps, Patrick has been involved in emergency service work from the day his ham radio ticket arrived in the mail. This included the West Virginia Field Day flooding of 1998, when the annual emergency preparedness drill took on a real-life meaning as the skies unexpectedly opened up:

"It was sad to see how many people lost their houses," said Patrick, who with his mother drove to the flood ravaged area to provide communications assistance. The story of one of the disaster victims still hangs in Patrick's mind:

"People showed up at the shelter having nothing. The incident I remember most is when a family came in and said that they had just lost their father, and the child did not have his medication ... and we need his medication because he is a diabetic ... so we contacted Metro 911 and got him his medication. And it sort of made Mom and I feel we had actually accomplished something and helped save a kid's life ..."

If you get the feeling that providing public service communications is almost a way of life for Patrick, you would not be wrong. In addition to his Amateur Radio Emergency Service (ARES) activities, KC8BFD is also a Certified Severe Weather Spotter with Skywarn, a National Weather Service volunteer program. He also holds certification in Basic Life Support and use of a defibrillator. While not a scout, he is a regular operator with the Jamboree on the Air, has spoken twice at the Dayton Hamvention Youth Forum, and promotes Amateur Radio to other youngsters through personal appearances. This includes the annual Sheriff's Youth Camp. And while maintaining a 3.5 grade point average, Patrick still finds the time to act as Net Control Station for the weekly Kanawha Amateur Radio Club's weekly 2-meter net. In his spare time, he is trying to get the Worked All States Award on 10 meters:

"I like the challenge of getting [awards like] the Worked All States Award (WAS). I am mailing out QSL cards tomorrow to try to get 42 states confirmed."

Among those commenting in favor of Patrick's nomination was Morris "Mac" McMillian W8XF, who is ARRL Section Emergency Coordinator for West Virginia. McMillian believes that the future of ham radio is in good hands with a young man like Patrick Clark KC8BFD:

"I have always been able to rely on Patrick's ability to think on his feet in a drill or actual ARES activation, both as EC and now as SEC," says W8XF, adding: "To how many youngsters can you turn over a brand new Yaesu FT-847 on Field Day and say, 'Go for it!'? I did just that with Patrick. Not only was he proficient with it, but he taught me new features on my radio!"

The 2001 *Newsline*™ Young Ham of the Year Award was presented on Saturday, August 18th, 2001, at the Huntsville Hamfest in Huntsville AL. The award ceremony was co-hosted by Bill Pasternak WA6ITF of Amateur Radio *Newsline*, and YHOTY Award Committee Chairman Larry Zettwoch KR4IF.

The presentation of the award as a regular feature of this prestigious Amateur Radio convention has been made possible through the generosity and kindness of the Huntsville Hamfest Planning Committee and its Chairman, Walter "Scotty" Neustadter W4WW.

The Amateur Radio *Newsline* Young Ham of the Year award program, (formerly the *Westlink Report* Young Ham of the Year), now entering its 17th consecutive year, is presented annually to a licensed Radio Amateur (ham) who is 18 years of age or younger and has provided outstanding service to the nation, his community, or the betterment of the state-of-the-art in communications through the Amateur Radio hobby/service.

Past recipients of the Young Ham award include Shawn Alan Wakefield WK5P, of Bartlesville OK (1986); David Rosenman KA9PMK, of Muncie IN (1987); Jonathan Binstock NK3D, of Potomac MD (1988); Erin McGinnis KAØWTE, of Topeka KS (1989); Mary Alestra KB2IGG, of Staten Island NY (1990); Richard S. "Sammy" Garrett AAØCR, of St. Louis MO (1991), and Angela (Angie) Fischer KBØHXY, also of St. Louis (1992); Kevin Boudreaux N5XMH of New Orleans LA (1993); Allison Daneen Zettwoch KD4CKP of Louisville KY (1994); Adam Weyhaupt N9MEZ of Alton IL (1995); Toby Metz KB7UIM of Boise ID (1996); Brian Mileshosky N5ZGT of Albuquerque NM (1997); Richard Paczkowski, Jr. KF4BIA, of Edgewater FL (1998); Michelle Swann KE4EZI of Warner Robins GA (1999); and Christopher Arthur KT4XA, of Russellville AL (2000).

Thanks to Newsline, *Bill Pasternak WA6ITF, editor.*

ARRL Says Hams Should Get 5 MHz Band

The ARRL says its time for ham radio to have a new band at 5 MHz, and it's asking the FCC to designate one.

A petition filed by the ARRL could result in a new high-frequency band for U.S. amateurs. The ARRL has asked the FCC to allocate 5.250 to 5.400 MHz to the Amateur Service on a domestic — U.S.-only — secondary basis.

The League told the FCC that the new band would aid emergency communication activities by filling a "propagation gap" between 80 and 40 meters. "There are times on certain paths when a frequency in the 80-meter band is too low, and a frequency in the 40-meter band is too high for reliable ionospheric propagation," the ARRL said in its petition. The ARRL said the propagation gap can hamper communication between the U.S. and the Caribbean during a hurricane or severe weather emergency.

The ARRL Board of Directors approved the proposal at its July 20-21 meeting. The FCC has not yet invited public comments on the petition. Even if the petition finds favor with the FCC, it's likely to be several years before the new band actually becomes available.

The ARRL said a new 150-kHz allocation at 5 MHz also could relieve substantial overcrowding that periodically occurs on 80 and 40. If the new band is approved, hams would have to avoid interfering with — and accept interference from — current occupants of the spectrum, as they already do on 30 meters. The band 5.250 to 5.450 MHz now is allocated to fixed and mobile services on a co-primary basis in all three ITU regions.

The ARRL's petition cites the success of the League's WA2XSY experimental operation in the 60-meter band, carried out since 1999, which confirmed the communication reliability of 60 meters.

"An amateur allocation in this band would improve the Amateur Service's already exemplary record of providing emergency communications during natural disasters when even modern communications systems typically fail," the ARRL concluded.

A copy of the ARRL petition is available on the ARRL Web site, [http://www.arrl.org/announce/regulatory/5MHz].

As suggested by the ARRL, amateurs General class and higher would be permitted to operate phone, data, image and RTTY on the new band running maximum authorized power. No mode-specific subbands were proposed.

Thanks to Rick Lindquist N1RL and the ARRL, via Newsline, *Bill Pasternak WA6ITF, editor.*

The NCVEC Wants to Hear from You

The new Chairman of the National Council of Volunteer Examiner Coordinators — the NCVEC — says that there are several issues he wants to bring to the attention of every ham in the United States and its possessions. John Creel WB3GXW, who was elected to the post on June 27th, says that while the VEC program is in great shape, there are some minor problems — but nothing insurmountable.

Creel says that the most important thing the NCVEC needs is closer ties to the ham radio community. He says the Question Pool Committee in particular needs ongoing input from every United States ham who is concerned about the future of the hobby. He adds that the NCVEC also has to find ways of improving testing opportunities in Alaska, where he says sessions are too few and too far in between.

Creel believes that the ham radio community probably has no idea of the unbelievable amount of time the Volunteer Examiner teams and the 14 VECs devote to the program. He notes that

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LETTERS

From the Ham Shack

Louis L. D'Antuono WA2CBZ. I've had such good response from the readers of *73* when I've been in need of materials or information, I thought I'd try it again with another item I am interested in. I need information on the Russian Volya or Volna military shortwave receiver. Please send information to me at 8802 Ridge Blvd., Brooklyn NY 11209. Thanks!

Tim Hamilton. I just got some third-degree chemical burns from a plumbing accident under the house (acid). My memory triggered the remembrance of the silver colloid generator parts I got from you but never built. I kicked into the assembly mode. I applied it internally and externally. In one week everything scabbed over nicely.

That stuff's magic — for cuts, burns, warts, jock itch, athlete's foot, ear infections, and rashes. The pure silver and a kit for making the stuff is available from Radio Bookshop (page 63). — Wayne.

Barry Sanderson KB9VAK, Indianapolis. Digital images have been successfully transferred from Australia to the United States on 20 meters using normal SSB radios. A computer sound card was used to provide the audio to the transmitter. Another computer sound card was used to record the audio from the receiver. Computer programs were used to generate the audio that was transmitted, and to recover the original image file from the audio that was received. Differential phase modulation and two levels of Reed-Solomon coding were used to transfer these image files.

A presentation describing this method was made at the Dayton Hamvention on May 19th, 2001. The slides from this presentation, as well as some that were not shown, are available at [http://svs.net/wyman/examples/hdsstv/index.html].

The source code used to transfer these images is distributed under the terms of the GNU Public License, which is included in the distribution via the URL [http://svs.net/wyman/examples/hdsstv/pm7b100.tgz]. This source code has only been used under the Linux operating system. Anyone wishing to port it to other operating systems is encouraged to do so. Questions may be E-mailed to [wyman@svs.net].

A number of SSTV images, using various modes, were transferred just after the digital transmissions were concluded. A comparison of the SSTV images and the digitally transferred images is available at [http://www.mindspring.com/~sstv/hdsstv/sstv-com0.html].

Sietse PA1XA. I think that Roger G3LDI hits the nail on the head in his analysis on the CW issue. Amateur radio isn't about numbers, but it's about quality. Lowering our standards might be the beginning of the end and will prove to be almost impossible to reverse. We should focus on interested and motivated people who are willing to do just that bit more. CW should be used as an attraction, not as an argument why people are not willing to be a ham op. I personally think that this argument isn't right — you first have to take a technical exam before CW comes in sight. Many people are not motivated enough to start studying for this technical exam, without even thinking about CW.

We shouldn't want to compete with the Internet and other digital hobbies, our strength is the magic in plain old radio, antennas, and propagation problems. The strength of our representation and arguments is much more important than the number of amateurs which those representatives represent.

CW is magic, and magic is what we need to attract new, motivated radio amateurs.

Au contraire — it's all about numbers. To keep our bands from being sliced and diced, quality isn't going to count. We're dealing with politics, and very rich corporations who want to buy spectrum. Our spectrum. — Wayne.

Richard C. Skolo KD7NKW, Salt Lake City UT. Here goes on try number two to write a coherent letter to convey a meaningful message.

You are a wise man. Very wise indeed. Therefore I need not spend a lot of time covering material that you have dealt with editorially in *73* magazine plurally.

Things like discovering an interest in two-way radio communications via CB in 1978. Or how natural it seemed to graduate quickly to a good SSB rig. Then on to an "export" President Grant and an 80 watt RF amp. I could talk all over the free, and sometimes not so free, world. One of the first stations I worked with this mobile station was in the Marshall Islands.

I was ready for more. *Eleven Meter Times and Journal* was good. So were *CQ*, *Ham Radio*, and of course *73*. *QST* never did flip my switch — I thought the contests and certificates were dorky.

Honestly, it was your often lengthy "Never Say Die" that I was looking forward to and buying. You were an insider who saw the problems very clearly. More importantly you offered solutions. You were there writing about the need for new hams. At the time I was 34 years old, newly married, one baby, and a desire for social contact while at work (driving).

The outreach from the ham community was not only nonexistent, but what I got was outright negative. Three of my customers were hams. They scoped my CB and free band ways as though it might be contagious. NO ONE wanted to show me their station and what it could do. I was a black sheep because I had dared to discover radio without opening the "ham" door first.

I still wanted more. In 1984 I bought *Tune In the World With Ham Radio* and started to read my way through that. My family had grown to two kids, one on the way, and the same old wife. I had plenty to do and my attitude had declined to "screw the hams!" After all, I had 11 meters and an estimated 20 million CB and free band stations out there to talk to. Who needs 'em? On a good day there were more CB and free band operators actually on the air than there were licensed hams. If ham radio could have "converted" just one out of ten 11-meter ops, ham radio could have doubled its numbers. Oops, now I'm sounding more like you.

By 1992 I had another son. My regularly assigned corporate vehicle that contained my station was retired and I was assigned a temporary van. My station was dismantled and put on the shelf of my garage and has never been used again.

Interest in radio faded. new things filled the void — even my sporadic purchase of *73* ended — sorry about that.

Then, this past April my church organized a ham class to generate new ops for our local 2m net. While much of America was wondering why we Utahans made such a big deal out of having a tornado tear through town in August of '99, we did learn that landline and cellular service was not the number to bet on in a real emergency. The church wanted new ops, and I did know a thing or two, so I signed up for the classes.

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707 2nd St.
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Antenna Tuning at the Speed of Light

Build your own 8-channel fiber optic control system.

I have never particularly liked antenna tuners. For several years, I worked on various types of HF antenna tuning units (ATUs) installed in aircraft. These were completely automatic units usually mounted near the antenna. From this experience, I learned that an ATU could do a very good job of antenna matching, and without adding more knobs to diddle with in the shack. These units, however, cost big bucks and ran off of 400 Hz AC or 28 volts DC or both. Newer generations of HF rigs often have built-in ATUs, but most will work only with particular radios. Then along came the LDG Electronics AT-11 antenna tuning unit, and my life was changed.

This article will describe a couple of additions/modifications I put in place using some readily available kits, 1mm plastic fiber optic cable, and my venerable AT-11. If you already have one of these units or are planning on getting one, you will want to add the flexibility my mods give your new toy. Refer to **Fig. 1**.

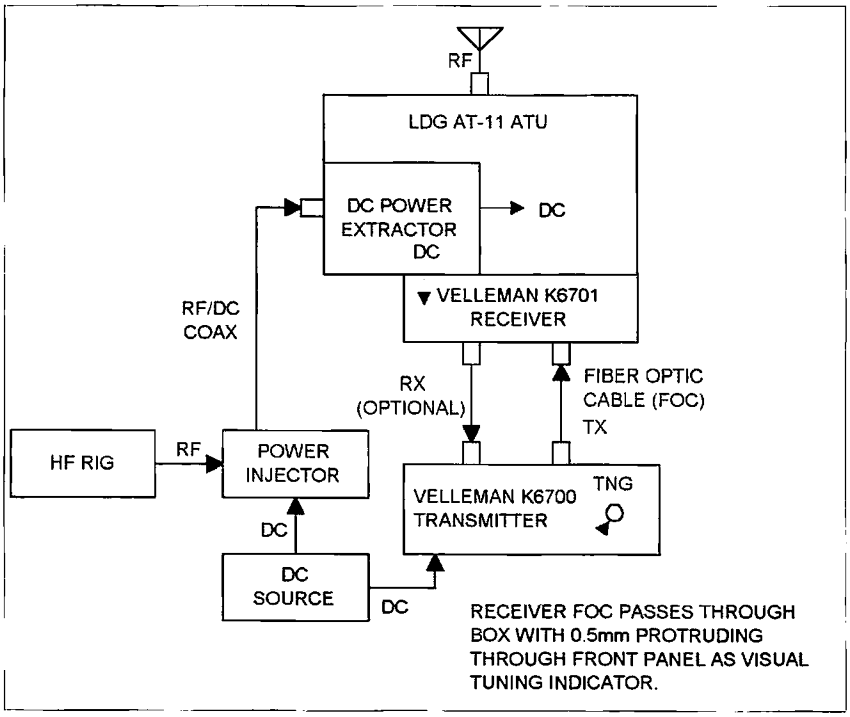

***Fig. 1.** Fiber optic control system. Receiver FOC passes through box with 0.5mm sticking out of the front panel as a visual tuning indicator.*

My system

The AT-11 is a microprocessor-controlled ATU that came as a kit and worked great the first time it was hooked up to my aging Kenwood TS-530S. However ... as a ham I was bound not to leave well enough alone. To start with, I did not want the ATU in the shack because tuners are intended to tune the antenna, not the coax between the radio and the antenna. My rig is located in the house, with the ATU mounted on the wall of a detached garage about 60 feet from the radio. The antenna is a five-band trap-type dipole attached to the garage roof; with this tuner, I am able to operate from 160 through 10 meters.

The AT-11 will operate in the automatic mode in this configuration, but to be able to use all of its manual functions, about 10 control wires would have to run from the shack to the ATU. This was too many wires; I have plenty installed already for other systems. I had previously modified my AT-11, adding a system that enabled me to send 12 volts DC down the coax with the RF to power the unit. However, the only control I had was to be able to turn the ATU on or off. There had to be a better way.

The solution

First, I elected to use 1mm plastic fiber optic cable instead of control wires so I would not have any RF pickup problems to deal with, and I wanted to use fiber to learn how to use it. With fiber I had to use serial data transfer of some kind. I then saw a Velleman-Kit catalog describing a couple of 2-wire, 8- and 10-channel pulsewidth modulation–type remote control systems.

There are now two kits that can be used for this project. The first kit is the K6700 transmitter with the K6701 receiver. This is an older kit and is being discontinued, but a check of dealers shows there are still many of the kits still in stock. The other kit is the new K8023; it uses a microprocessor to encode and decode the commands and consists of the P8023S transmitter and the P8023R receiver.

With a little modification, either of these kits is able to communicate using plastic fiber optic cable for the signal path. The plastic cable used is *very* easy to work with. You need only common tools to work with it and there are a variety of emitters, detectors, and splices available to use with it. Whichever kit you choose to use, first build the kits according to the instructions and then ensure they work as advertised before you do the modifications I outline. The required modifications are described below.

As I said, the AT-11 is a great little device which I modified just enough to get my system to do what I wanted. All of the modifications are additions to the existing circuits and do not require any major surgery to the unit that could do more damage than good. The first modification, and possibly the only one you may want to do, is to add a power injector/extractor system in the RF circuit, allowing you to power the ATU remotely by way of the RF coax.

DC power

The DC power injector is simple and easy to build. [See **Fig. 2(a)**.] This should be built in a small metal box or inside the rig you're using. Mine is built in a small metal box with BNC connectors for the RF, and the DC is fed into the box with an RCA type connector. I get the power from the TS-530S filament supply; that way, the tuner can be active only when the "Heater" switch is on.

The power extractor in the ATU

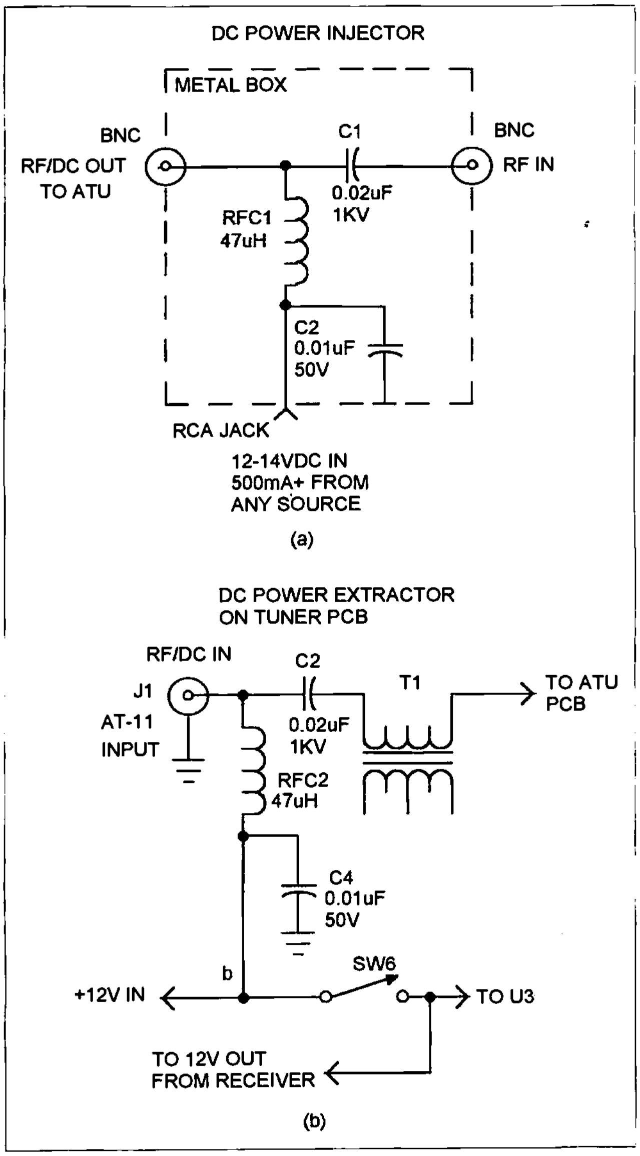

Fig. 2. (a) DC power injector at the rig. (b) DC power extractor on tuner PCB.

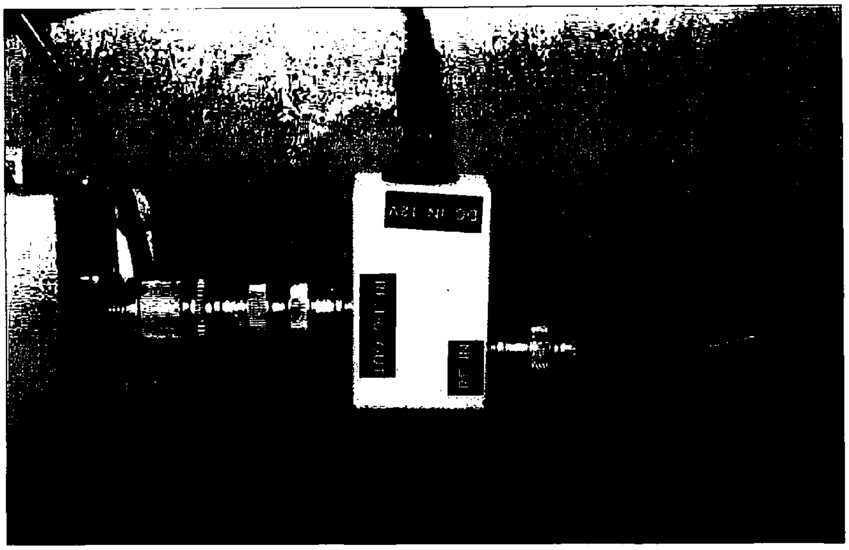

Photo A. The finished power injector. DC is derived from the HF transceiver but can be from any source. (Photos by author)

consists of two disc ceramic capacitors and a small RF choke. [See **Fig 2(b)**.] The 0.02/1 kV capacitor is connected between the RF input connector and the circuit board. The capacitor's lead going to the printed circuit board is used as the one turn winding that goes through the center of the core which makes up T1. T1 is the SWR sensing transformer, which is a part of the AT-11 kit. The RF choke on the connector side is a small 47 µH unit which I had in the junk box.

The values of the capacitor and inductor do not seem to be critical. Just keep in mind that the total current of the ATU must go through the choke, so keep the DC resistance as low as possible. Also, remember that all of the transmitter power will be going through these blocking capacitors, so use high-quality disc ceramics or trans- mitter-grade micas. The 0.01/50 V capacitor adds a bit more RF decoupling right at the choke. No problem with RF on the DC line has ever been noted.

Control transmitter modifications

K6700

Next, building and modifying the transmitters. I'll start with the K6700. The kit is built as instructed. Then, from the DO pin connect a 220 ohm resistor and U6, an IF-E97 super bright red emitter, which is an integrated red LED fiber optic coupler assembly. Remove R9. (See **Fig. 3**.)

P8023S

Build the entire kit. Then, connect U8, another IF-E97 red LED emitter, across T2; from the collector to the emitter of the transistor. [See **Fig. 5(a)**.] This is all that has to be done to convert the transmitter to an optical emitter.

To test the optical transmitters, you can check their operation by applying power; the red LED emitter should come on. If you have a scope, hook it across the LED emitter; you should get a trace of what looks like a few cycles of a square wave. As you operate each switch on the transmitter, at least one of the square waves should change shape, indicating the transmitter is working.

My control transmitter in the shack is housed in a general purpose plastic box and powered by the same source as the ATU. You will notice in the photo that there are two fiber optic connectors on the back of the transmitter. I'll talk about those later.

Receiver modifications

K6701

Again, the kit is constructed and tested as instructed. Then, an IF-D95OC photologic detector fiber optic coupler assembly, U5, is connected to the input pin D and R11 is replaced with a 1k resistor. (See **Fig. 4**.) **Photo E** also shows the entire receiver/interface.

P8023R

This receiver is almost as easy to modify as the transmitter. First, disconnect the collector lead of T1 from the printed circuit board — just leave it sticking out in the air. Then connect U7, the IF-D95OC optical detector, as shown in **Fig. 5(b)**. That's it — the

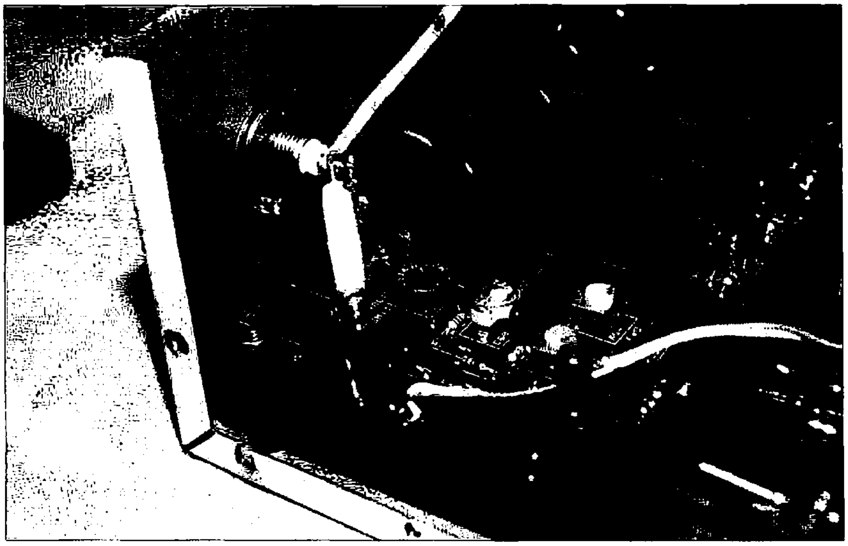

Photo B. The power extractor mounted inside the tuner enclosure, showing one lead of C3 passing through T1, a part of the ATU.

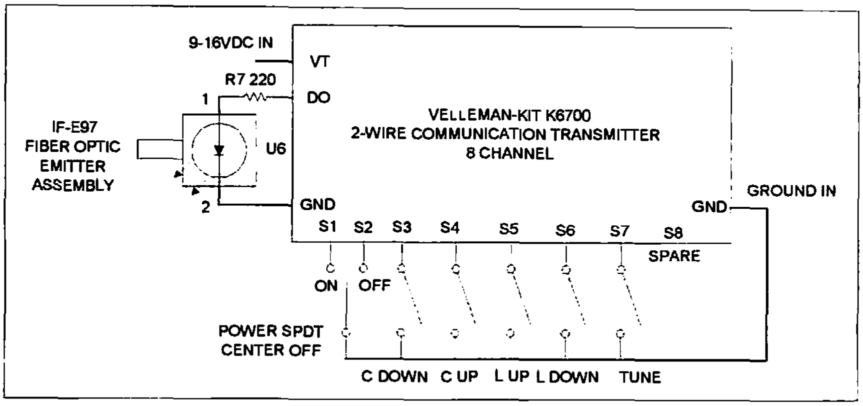

Fig. 3. Control transmitter locatod at rig in the shack.

receiver is now ready to be connected to a transmitter by the fiber optic cable and a system test run.

A's a quick test, power up the receiver/transmitter system and select commands; the various channel indicator LEDs on the receiver should light as you select them on the transmitter. If you want to confirm that the data is being carried by the fiber optic cable and not the two original wires, connect the receiver or transmitter to its own battery supply and test the system again. That was the easy part; the interface to the ATU gets a little more complicated but it works great.

Interface/System Integration/ Checkout

The K6701 receiver has eight outputs; the K8023 receiver has 10 outputs. When a valid code is received, the appropriate output of the receiver goes low. I used seven of these outputs to control all of the ATU's manual functions: C up/down, L up/down, power on/off, and manual tune command. I used no particular order when choosing which output did what — I just started with output 1 and used it as the power on function, and on through to output 7.

My way of controlling the power

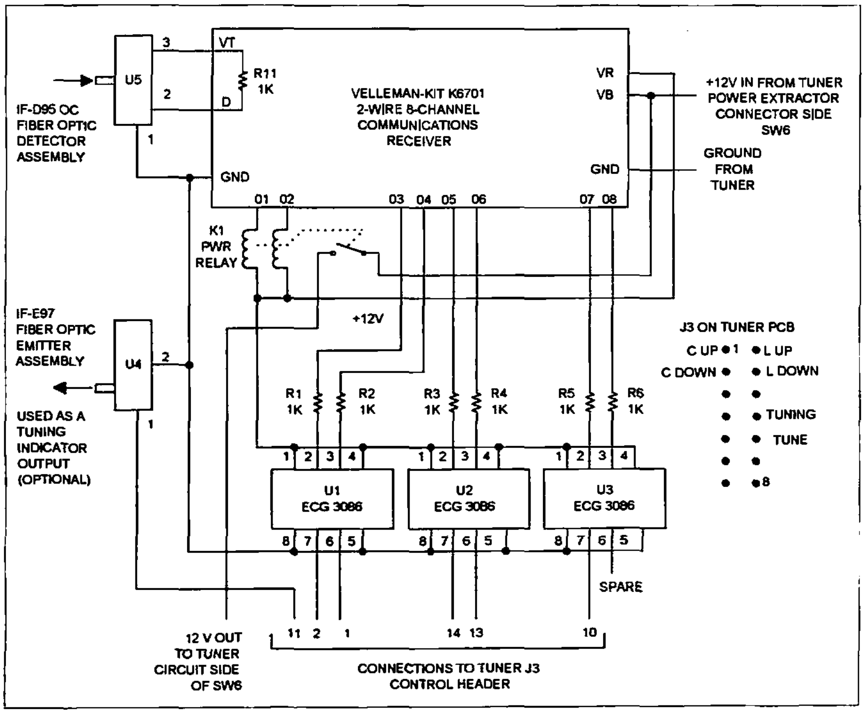

Fig. 4. Receiver/interface mounted on tuner cabinet.

on/off needs some explanation. I used a two-coil latching relay; output 1 of the receiver sets the relay on, applying power to the ATU, and output 2 resets the relay, which turns the ATU off. I did it this way because I had never used this type of relay before and I wanted a relay to carry the higher current of the ATU, which is about half an amp when tuning. The rest of the outputs are connected by way of optical couplers to the ATU and its microprocessor. Each time a valid output comes from the receiver, a coupler applies a low to the ATU just like one of its push-buttons.

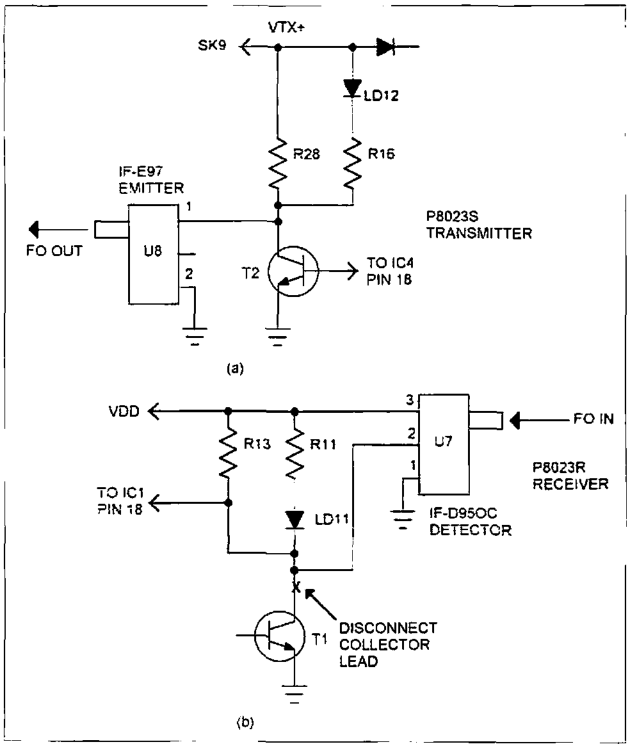

Fig. 5 (a) P8023S transmitter. (b) P8023R receiver.

I used optical couplers to isolate the two systems from each other. Optocouplers are a single component consisting of a light source and photodetector. These elements are isolated from each other inside the assembly, which is enclosed in an opaque plastic package — usually a six-pin dual-inline package. Inside the ECG-3086 the light source is an LED; the detector is a light-sensitive NPN transistor, which is the output element of the device. Signals from the receiver light the LED inside the coupler, which turns the transistor on and thus passes the signal on to the ATU. The two elements cannot reverse their operation and, since there are no electrical connections between them, the signals from the receiver pass through the unit in one direction. This provides isolation between the receiver's power system and that of the ATU. I wanted to have this isolation in case there were a small difference in their voltage levels which could possibly confuse the logic in the ATU. Also, because of the one-way operation of the device, any logic noise generated inside the ATU by the tuner is not passed back into the control receiver.

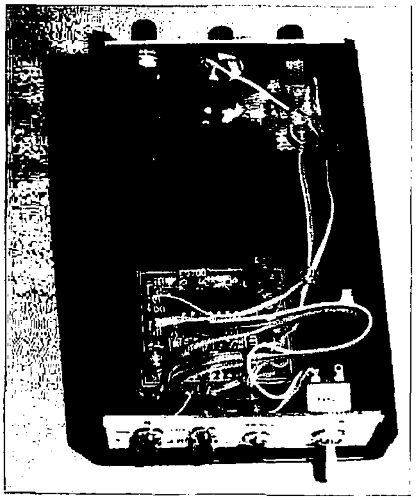

***Photo C.** Inside the receiver. The two fiber optic cables (FOC) and power enter from the rear. If used, the tuning indicator FOC enters on the left rear in this view, passes through the enclosure, and protrudes about half a millimeter out of the front panel.*

Fig. 4 shows the interface circuit as built for the K6701. A version for the K8023 will have two additional outputs and will require additional optocouplers. The interface connections are made to the ATU's circuit board by wires that go through the wall of the two boxes. I got the wires through the sheet metal by using bolt-style filters. These filters are small ferrite and ceramic capacitor devices built into a metal housing with bolt threads on one end which are used to bolt the filter on the chassis. Passing through the center of the filter is a solder wire eyelet to which you solder the control wires, thus passing the desired signals through the box wall. Try operating the system without these filters first. If the system seems to work but responds erratically to commands, installing these filters or similar ones is what I would try first. However, I don't think you'll have any problems. Once inside the ATU box the wires connect to J3, the 14-pin header solder points provided by the tuner designers. In other words, the interface is connected in parallel with the ATU manual control switches.

The receiver kit and interface circuits are mounted in a metal box which is physically attached to the ATU. I did it this way so I would have only one unit to mount on the wall. The ATU and the control receiver could be in separate boxes connected by cabling — it's up to you. I used some vector-type board, the stuff with all the little holes, and point-to-point wiring for the interface and receiver assembly.

Interface testing

With the receiver-interface assembly completed, do a partial system test. Apply DC power to the receiver-interface board. Connect the transmitter and receiver together with a length of your fiber optic cable and go through the tuner commands. If you used a relay for power on/off, you should be able to switch this on and off and hear the relay or monitor it's functioning with a multimeter. If that is working, you should then check the individual outputs from each of the optical couplers.

To test the couplers, I used a DMM and a 1k pull-up resistor. Connect one end of the resistor to the +DC into the board, the other end of the resistor to the + probe of your DMM; the negative

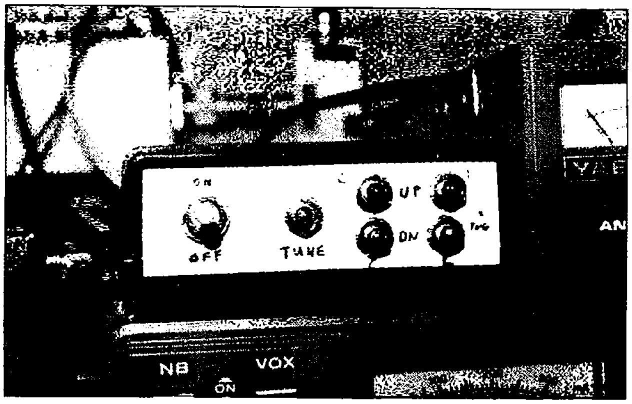

Photo D. Front view of the transmitter, with the TUNE indicator on the right marked TNG.

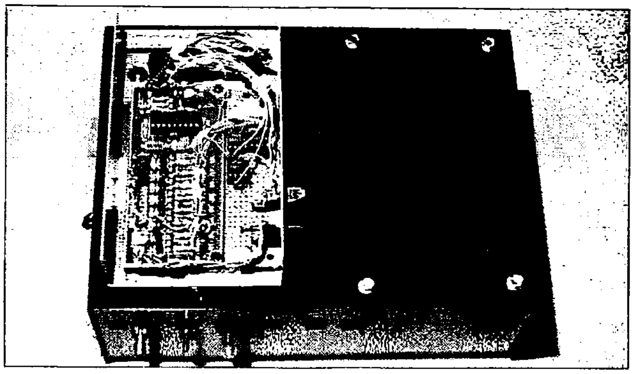

Photo E. The receiver/interface mounted on the tuner enclosure. The interface portion is built on a piece of vectorboard that also has the receiver circuit board mounted on it.

probe of course goes to ground (GND). Temporarily connect the resistor/probe combination to one of the coupler outputs; you should read a positive voltage. Switch the appropriate switch for that output on the transmitter; the DMM, set to DC volts, should go low, almost to ground. Do this with each output. If these all test good, you're ready to connect the receiver/interface system to your tuner. With all power removed from the tuner and receiver, a small soldering iron and a steady hand make the new connections within the AT-11.

With this complete, you should connect your entire control system together on your bench. You don't need your rig yet unless that is where you are getting your DC power to run everything. On the ATU set the POWER ON/OFF switch to the OFF position, set the AUTO/SEMI switch to the SEMI position. Apply power to your power injector/extractor system and the control transmitter. You should have power at the ATU circuit board on the +12 V IN side of SW6 and into the control receiver. Turn the tuner system on using the ON function of the transmitter. If you used a power relay as I did, you should hear it energize. If you used the tuning indicator LED U4, it will flash on for about half a second when you apply power. In the tuner you should now have power on the 5-volt regulator side of SW6; this means the tuner is energized.

As I mentioned earlier, there are two fiber optic cable connectors on the rear of the transmitter. The second one is a luxury item. I already had two runs of plastic cable going from the shack to the antenna tuning unit in the garage so I used the second one to give me visual feedback on the tuner's operation. The ATU has a tuning in progress output at pin 11 of J3. This is high whenever it's tuning and when it is powered up. I used this output by connecting another IF-E97 super bright red LED emitter, U4, to this output. [See **Fig. 4**.] The second fiber then connects to this coupler and continues physically into the control box of the transmitter in the shack with just a very small tip of the fiber sticking out of the front panel through a small hole. This is a nice indicator to have, but if you don't want the extra cost of the second cable system, it can be eliminated.

System testing, 1, 2, 3...

Now would be the time to connect the whole system together and test it

Continued on page 58

Part	Description
C1, C3	0.02 µF, 1 kV disc ceramic
C2, C4	0.01 µF, 50 V disc ceramic
FOC	Fiber optic cable, Digi-Key A1700-X-ND, Industrial Optics simplex cable IF-C-E1000, duplex IF-C-D1000, tel. 602-804-1227
K1, K2	Aromat DS2Y-SL2-DC12V, Digi-Key 255-1083-ND
K6700	Velleman Kit 8-channel transmitter
K6701	Velleman Kit 8-channel receiver
R1–R6, R11	1k ohm, 1/4 watt carbon
R7	220 ohm, 1/4 watt carbon
RFC1, RFC2	47 µH choke
U1–U3	ECG 3086 optical isolators
U4, U6	IF-E97, Industrial Fiber Optics bright red LED emitter
U5	IF-D95OC, Industrial Fiber Optics detector
Filters, bolt-style (optional)	Allied Electronics, Inc., 1-800-433-5700, [www.allied.avnet.com], P/N 512-6876 or 512-6874

Table 1. Parts list.

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CTCSS Encoder-Decoder Test Device

Nice article + Useful piece of equipment = Construction fun!

It has been said many times that hams can never have enough test equipment because it provides the "eyes" that allow a ham to "see" into electronic circuits. As a result, test equipment is something every ham needs to have on his workbench. In many cases the equipment will sit idle for long periods of time, but when it is needed, it had better be there and be functional.

Being an active builder of ham-related projects. I find test equipment extremely important. Because of the expense of commercial test equipment. I try to build the items that I need, and I needed the one described here to assist in a recent project (see **Photo A**). The CTCSS test device is one of those items that falls into the rarely used category, but is certainly an essential device for some applications. Besides, it was fun to build and use in various experiments.

I'm responsible for the technical aspects of four ham repeaters in the Los Angeles basin and, as a result, upon occasion I need to work on one or more of them. When I do, I had better have the needed test gear available.

Before continuing, perhaps a definition of the terms to be used should be addressed, as there could be some confusion with the terms CTCSS, Encode, and Decode. The names of these terms may be different as described by the various manufacturers of equipment, but in each case, the functions are as described below.

CTCSS is short for "Continuous Tone-Coded Squelch System." When used, a continuous subaudible tone is transmitted along with voice audio to open (key) the squelch circuit of a receiver, allowing the voice to pass through to the speaker. In the absence of the tone, the receiver would ignore the incoming signal.

In addition, CTCSS tones may be used between stations operating simplex. With a tone present, the receiving station can select which transmitted signal is to be received. You could call

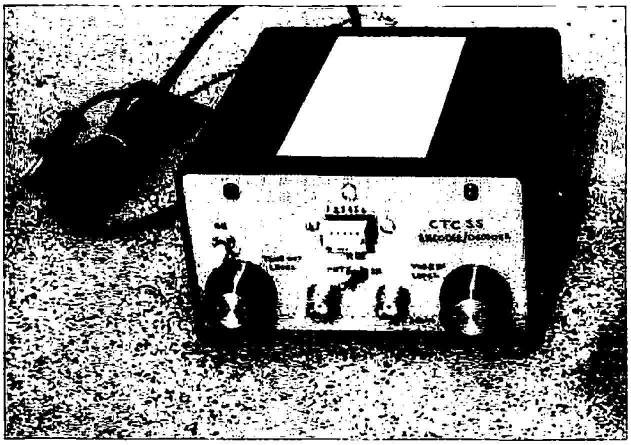

***Photo A.** This is the completed CTCSS Encoder-Decoder Test Device.*

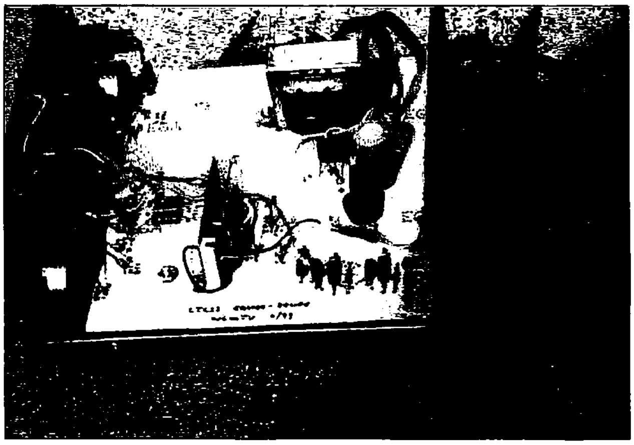

***Photo B.** Internal view of the CTCSS Encoder-Decoder Test Device showing the general parts placement.*

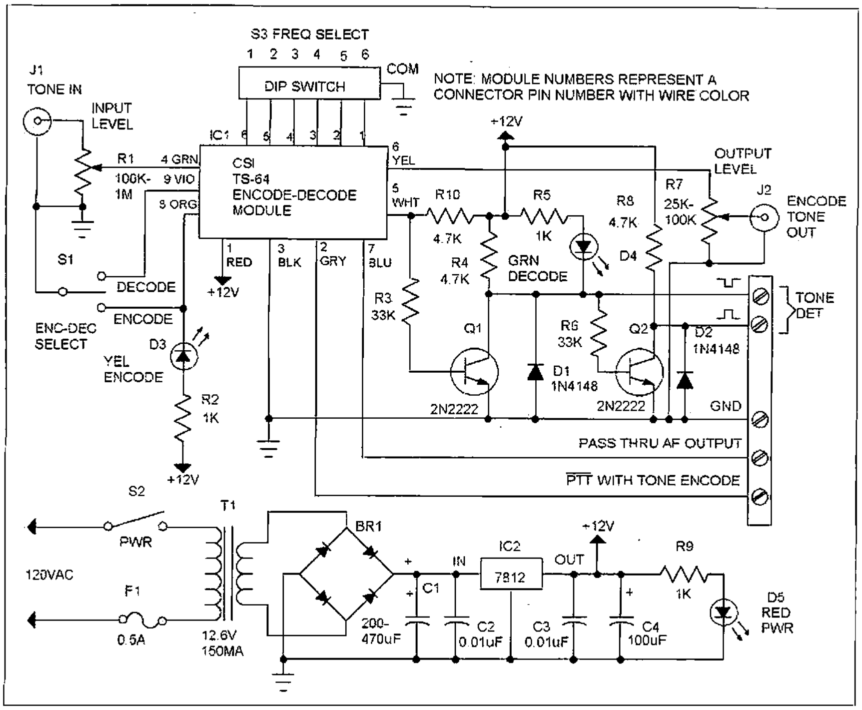

Fig. 1. CSI Encoder-Decoder model TS-64 used in the CTCSS test device. Note: Module numbers represent a connector pin number with wire color.

it selective receiving, in that it allows the receiver to remain quiet until a desired signal (including tone) appears.

The terms Encode and Decode may conjure up the notion of something secret and perhaps to be kept away from the majority of people — actually, that isn't true. In this case, to encode a tone means simply to generate a subaudible tone that will be transmitted along with the audio (voice) modulation. Being both low in frequency as well as in amplitude, the tone is typically not heard by the station listening to the audio. Without the presence of the tone-encoded system, a remote transmitter would be subject to being keyed by extraneous and uncontrolled signals. The presence of the tone helps in maintaining control of the remote transmitter.

The term "decode" relates to the receiving end of the tone path. If a receiver is set to detect the presence of a tone, then the receiver will remain silent until a designated tone, along with the signal carrier, appears at the receiver.

Not too long back I was working on a system and needed to add a CTCSS tone to my signal generator so that I could assess the level of sensitivity required by the CTCSS decoder unit attached to the repeater's receiver. Using a handheld radio worked OK for accessing the repeater, but it didn't solve a tone sensitivity level issue. The question at hand was whether the CTCSS decoder was being overdriven, since it was responding to adjacent CTCSS tone frequencies causing the repeater to operate inappropriately.

Well, "necessity is the mother of invention," as the saying goes, so I doubt that the CTCSS Encoder-Decoder Test Device is unique in the test equipment world. However, I needed one urgently and happened to have a spare CTCSS board available that allowed the spawning of the device described.

Since building the CTCSS device, I've found it to be very useful; some of its applications include:

- generating a CTCSS tone for accessing a repeater using a transmitter being worked on;
- providing a CTCSS tone for a signal generator's test signal;
- generating a carrier signal having a CTCSS tone to check the keying sensitivity of a receiver; and
- generating accurate audio frequencies in the 33–254 Hz range.

I'm sure there are other encoder applications that will come to mind as

Tone number	EIA code	freq Hz	switch code 123456
1		33.0	---45-
2		35.4	---456
3		36.6	--3---
4		37.9	--3--6
5		39.6	--3-5-
6		44.4	--3-56
7		47.5	-23---
8		49.2	-23--6
9		51.2	-23-5-
10		53.0	-23-56
11		54.9	-234--
12		56.8	-234-6
13		58.8	-2345-
14		63.0	-23456
15	A1	67.0	------
16		69.4	-2-456
17	B1	71.9	1-----
18	C1	74.4	-----6
19	A2	77.0	12----
20	C2	79.7	----5-
21	B2	82.5	1----6
22	C3	85.4	----56
23	A3	88.5	12---6
24	C4	91.5	----4-
25	B3	94.8	1---5-
26		97.4	---4-6
27	A4	100.0	12--5-
28	B4	103.5	1---56
29	A5	107.2	12--56
30	B5	110.9	1--4--
31	A6	114.8	12-4--
32	B6	118.8	1--4-6
33	A7	123.0	12-4-6
34	A7	127.3	1--45-
35	A8	131.8	12-45-
36	B8	136.5	1--456
37	A9	141.3	12-456
38	B9	146.2	1-3---
39	A10	151.4	123---
40	B10	156.7	1-3--6
41		159.8	-2-45-
42	A11	162.2	123--6
43		165.5	-2-4-6
44	B11	167.9	1-3-5-
45		171.3	-2-4--
46	A12	173.8	123-5-
47		177.3	-2--56
48	B12	179.9	1-3-56
49		183.5	-2--5-
50	A13	186.2	123-56
51		189.9	-2---6
52	B13	192.8	1-23--
53		196.6	-2----
54		199.5	--3456
55	A14	203.5	1234--
56		206.5	--345-
57	B14	210.7	1-34-6
58	A15	218.1	1234-6
59	B15	225.7	1-345-
60		229.1	--34-6
61	A16	233.6	12345-
62	B16	241.8	1-3456
63	A17	250.3	123456
64		254.1	--34--

Table 1. *Switch positions for selecting the 64 CTCSS tones for the TS-64 encoder-decoder board. The C1116 encoder-decoder board will select only tone numbers 15 to 64 (67–254.1 Hz).*

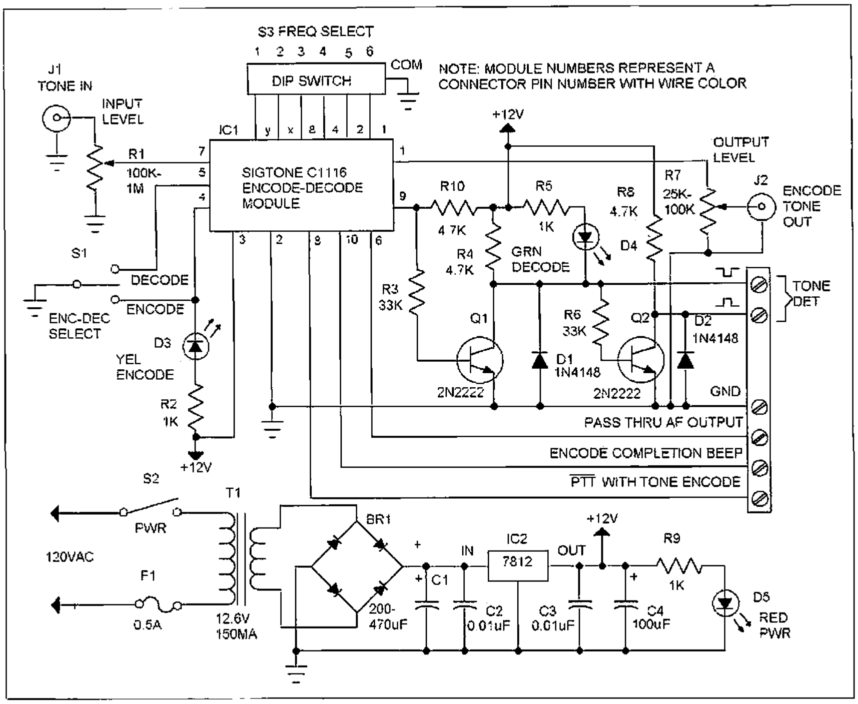

Fig. 2. Sigtone Encoder-Decoder model C1116 used in the CTCSS test device. Note: Module numbers represent connector wire color coding.

the device is needed now that it is available.

On the receive, or decoder side of the device, I've found it to be useful for the following:

Function	Spec
Freq range	33.0–254.1 (64 tones) 67–250.3 Hz(37 EIA STD tones)
Freq accuracy	Better than 0.05 Hz
Operating Voltage	6–20 VDC @ 6 mA
Encode	
Max output level	3.0 Vrms
Output impedance	2k ohms
Purity	1.5% THD
Turn-on time	Less than 2 ms
Decode	
Max input sensitivity	10 mV rms
Input impedance	50k ohms
Decode bandwidth	2% total
Detection response time	Less than 200 ms
Speech rejection	Greater than 2 dB (300–3,000 Hz)

Table 2. CTCSS Encoder-Decoder Test Device specifications used for general reference.

- for checking the output of a CTCSS encoder board on a system;
- to assess the level of a generated tone; and
- to identify/verify the tone frequency being generated by another device.

The decoder is also useful in identifying a subaudible tone frequency being transmitted on a received carrier — though a little cumbersome for searching due to the DIP switch frequency selection scheme.

The CTCSS device

Building up the CTCSS device is fairly simple because all of the electronics, with the exception of the power supply, are mounted on a preassembled CTCSS encoder-decoder board (see **Photo B**). Some encoders and decoders are made on separate boards, and using one of each in the project would work well. Combined encoder-decoder boards are available from several sources and are adaptable for the application described. A review of the data sheet for the specific board would be required to ascertain the proper wiring connections required for that board.

I happened to have a CSI™ TS-64 encoder-decoder board available for my project that is shown in **Fig. 1**. The board provides 64 frequency selections, of which 37 are commonly used (called the EIA standard tones). For convenience, a selector switch would normally be desired for selecting a specific tone frequency when used in a piece of test gear, but with 64 combinations, I chose to use a 6-pole DIP switch. The switch selection combinations for my device are shown in **Table 1**. A unique chart of combinations would be required for each specific CTCSS board available should they differ from the chart shown. Such a chart should be supplied with each board obtained. If a chart is not available, then you can develop one by measuring the output frequency of each switch setting combination, and then building a matching chart.

An alternate encode-decode board suitable for use in the CTCSS Test Device is the Sigtone™ model C1116. It will provide fifty CTCSS tone frequencies. **Fig. 2** shows the schematic of the C1116 configured to operate in the test device as described for the CSI TS-64. The external circuit differences are minor, allowing both boards to function well in the project. The frequency and switch chart for the C1116 is shown in **Table 1**, with the limitations noted. I believe the Sigtone company is now out of business, but their boards are still around and appear at swap meets periodically. I got mine through a swap meet purchase.

In use

Table 2 shows the general specifications for the CTCSS Encode-Decode Test Device. The values shown may vary to some degree, based upon the specific characteristics of the board being used. Major items on the front panel are as follows:

- I elected to use BNC coax connectors for tone in and out signals (see **Photo C**) — phono connectors would work as well. However, I've found the use of a 1:1 scope probe having a BNC connector to be the most advantageous method for connecting the CTCSS device to a radio. A short

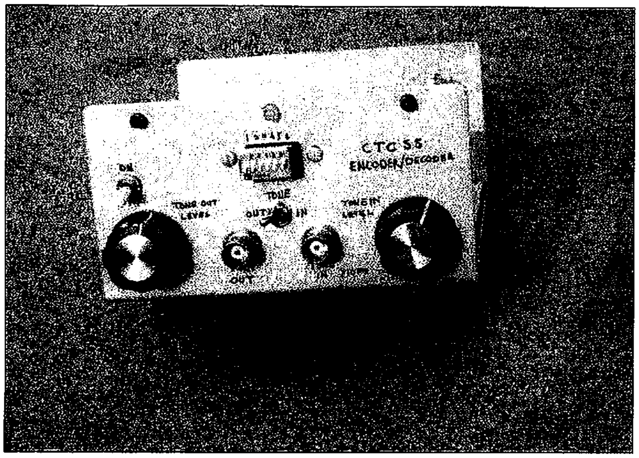

***Photo C.** This is the front panel showing parts placement. A 6-pin DIP switch is used for selecting one of 64 CTCSS frequencies.*

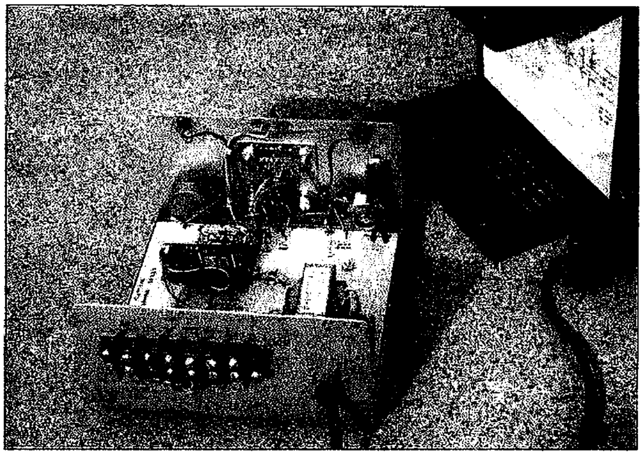

***Photo D.** Internal view showing the front panel and the DIP switch circuit board. The terminal block is shown on the rear panel.*

length of coax is used to connect the CTCSS Test Device to the signal generator.

• Three LEDs are mounted on the front panel to show device status, with a red LED used for indicating power "ON".

• A green LED on the front panel will illuminate when receiving a selected tone to indicate that a tone is being detected.

• A yellow LED will be illuminated when a tone is being generated.

• Potentiometers on the front panel are used to vary the amplitude of the generated tone and the level of the received tone.

A terminal block is mounted on the rear panel to provide access to the logic and audible outputs available from the TS-64 (see **Photo D**).

Construction

Fig. 1 shows the schematic for my device, with the power supply and output logic drivers being the main portions to be constructed (**Fig. 2** shows the use of the C1116). The remaining circuitry is used for making connections to the encoder-decoder board. **Photo B** shows the general parts placement that I found convenient. Again, parts placement is noncritical in this application. The CTCSS board may be mounted in any position, but I chose to mount mine vertically so that I could see both sides of the board.

Transistors Q1 and Q2 appear to be redundant in their function as related to the direct output from the board. The logic output from the board "goes high" when a tone is detected and transistor Q1 inverts the logic function, providing a logic "low." Transistor Q2 inverts the logic again to repeat the "high" from the board. The objective of using Q2 to repeat the board's output logic is to do two things: (1) to isolate and protect the board from the outside world; and (2) to increase the current sink capability of the output device. Diodes D1 and D2 were added as reverse voltage protectors for the transistors, should the CTCSS device ever be used to drive a relay coil.

Lesser-used board functions are brought out to a terminal block mounted on the rear of the chassis, making them accessible should they be needed (see **Photo D**). The objective was to provide access to the audio and logic outputs provided by the CTCSS board. For my normal applications of the CTCSS test device, those connections are unused.

Parts used in the construction of the test device are really noncritical and available through most parts outlets. A parts listing is shown in **Table 3**, and in the case of need, parts substitution is encouraged. The most critical item is the CTCSS encoder-decoder board(s), which is (are) available from several sources, but I recommend using the CSI TS-64 both for function and availability. When choosing a board, make sure that it accommodates external DIP switches for frequency control, and is able to respond to a received tone and to generate a tone.

Construction of the CTCSS Test Device is primarily mechanical, except for the construction of the power supply, logic output, and wiring to the front and rear panels. Because of the low frequency involved, wire routing and bundling is not an issue. However, AC power routed to the front panel

Part	Description	Source*
R1	100k–1 meg pot	
R2, 5, 9	1k 1/4 W	
R3, 6	33k 1/4 W	
R4, 10, 13	25k–100k pot	
R7	4.7k 1/4 W	
C1	200–470 µF 25 V elec cap	EG G9093/G9097
C2, 3	0.01–0.02 µF disc ceramic cap	
C4	100–220 µF 15–25 V elec cap	
D1, 2	1N4148 or equiv diode	EG G9245
D3	Yellow LED	EG G1007/G5305
D4	Green LED	EG G1006/G6164
D5	Red LED	EG G1113
J1, 2	BNC panel mount coax connector or equiv.	
SOC	14-pin DIP socket	EG G4381
S1, 2	SPDT toggle switch	EG G1944/G1485
S3	6-pole DIP switch	
Q1, 2	2N2222/2N4401 or equiv. NPN gen. purpose transistor	EG G4210/G8566
IC1	CSI TS-64 CTCSS encoder-decoder board	Communication Specialists, 426 W. Taft Ave., Orange CA 92865-4296; 1-(800)-854-0547
IC1 Alternate	Sigtone C1116 CTCSS encoder-decoder	
IC2	7812/LM340T-12 12-V reg.	EG (P/N N/A)
F1	0.5 A fuse any style	
T1	120/12.6 V @ 200–500 mA pwr xfmr	EG G8535 (250 mA) EG G4266 (350 mA) EG G6071 (750 mA)
Term	5-6 screw terminal block	
Chassis		Radio Shack #270-253A
Knob		Radio Shack #274-416A
Misc	PCB material, hardware, wire, etc.	

*EG = Electronic Goldmine

Table 3. *Suggested parts listing for the CTCSS Encoder-Decoder Test Device. Parts may be substituted as desired. EG = The Electronic Goldmine, P.O. Box 5408, Scottsdale AZ 85261; tel. 1-800-445-0697 or (480) 451-7454; [http://www.goldmine-elec.com].*

switch should be kept away from the tone wiring to reduce the introduction of hum. Power line hum falls within the operating frequency range of a CTCSS device.

Although the CSI TS-64 board operates on a supply voltage from 6–20 VDC, I chose a 12 V regulated supply to provide a stable and hum-free source.

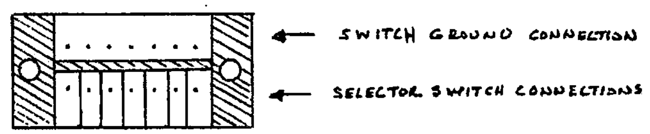

Fig. 3. *Suggested board layout for mounting a 14-pin DIP switch socket. Only 12 of the 14 pins are used.*

DIP switches select a frequency by grounding the select lines per the chart shown in **Table 1**.

The mounting of the DIP switch to the front panel is accomplished by laying out a small piece of circuit board for a 14-pin DIP socket (see **Fig. 3** and **Photo D**). The board is made longer than the socket so that two screws may be used to mount the board onto the inside of the metal front panel. With a 14-pin DIP socket installed on the board, washers are used as spacers to place the top of the socket flush with, or recessed slightly behind, the front surface of the panel. A 6- or 7-pole switch may be used for frequency selection. A 6-pole DIP switch, when inserted, is shifted to one end of the 7-pin socket. When a 7-pole switch is used, the 7th switch position is ignored. A 5-pole switch may be used with boards accessing only the 37 EIA frequencies. Wiring to the switches should be from left to right, as viewed from the front of the panel, to match the numbering found on most DIP switches. The objective of using a DIP socket is to allow changing of the DIP switch should it become damaged.

LEDs are mounted by gluing them with contact cement into holes drilled in the panel that are just slightly larger than the LED body diameter. Thin wires with extra length are soldered to the LED leads to reduce tension on the glue holding the LED to the panel.

Conclusion

The primary objective of this discussion regarding the CTCSS Encoder-Decoder Test Device is to encourage the construction of test equipment to fit a ham's need even in cases where the equipment may not have frequent use. In most instances, the construction of a project is aimed primarily at "building and learning" from experimentation and construction. Ending up with a useful piece of test gear is the reward for the effort expended.

Since building up the CTCSS project, I've had a lot of fun just "playing" with it and placing it into as many applications as possible. It's been a "fun" project, and one that was easily constructed. Give it a try! 73

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Your Long-Lost Transistor Notebook

Part 4 of 4.

This is the final part of our tour. We started off the series by generating characteristic curves for common transistors found in a ham's "junk box." With the curves in hand we began a tour of designing a common Class-A amplifier circuit requiring that we work out component values based upon our choices of the variables involved.

To complete our tour, we need to select component values, determine the input and output impedance, and the roll-off frequency exhibited by the circuit.

Calculating resistor values

The next step in the process is to determine the base biasing resistor values for R1 and R2. These are user-selected to meet a desired input impedance for the stage, which is basically the load that will be placed on the circuit driving the stage that we're designing. Resistor R2 is the major contributor to the input impedance and its value may be selected either by "picking" a value or by working the math to select it. After a little experience with circuit design, the selected value will essentially be the same for most general applications.

Since we're doing the design from scratch, let's use the mathematical approach, then adjust the calculated value to use common resistor values.

We know the desired base current for QOP and that current must be sourced through resistor R1 as shown in **Fig. 1**. In addition, the current flowing through resistor R2 will also be sourced through R1. We also know that the supply voltage, Vcc, is placed across resistors R1 and R2, but as yet we don't know the voltage across resistor R2. As a circuit designer, you have some flexibility in the selection of the voltage across R2.

An approach for determining the voltage across R2 is to start with the voltage across R4, which is the emitter resistor. Again, you as the designer have a choice in the voltage to be selected. Whatever voltage value that is chosen to be across resistor R4, it must be subtracted from the Vcc value applied to the circuit. Your question might be, "What difference will that make in the circuit performance?" To answer that question, look at the load line shown in **Fig. 2**, where we chose 12 V for Vcc. The value of 12 V is also the bottom end of the load line, and any voltage that we choose to have across resistor R4 must be subtracted from 12 V. The resulting lower voltage will shift the load line to the left where the change may or may not have any noticeable effect on circuit performance.

A safe method for selecting a voltage across resistor R4 is to choose the voltage to be 10% of Vcc, and in our example that will be 1.2 V. The actual voltage to be selected may vary from the 10% value as needed to meet the desired circuit performance.

However, we've selected 1.2 V to be across resistor R4. Since junction transistors have a voltage drop of approximately 0.7 V between base and emitter, we add 1.2 V and the 0.7 V to obtain 1.9 V, which is the voltage across resistor R2. If you wish, you may choose to use 2.0 V instead if it makes the next set of calculations easier.

Using the circuit shown in **Fig. 1**, we've selected resistor R3 to be 4.7k and have determined the base QOP current value to be 6 μA.

The next calculation is to determine the values for resistors R1 and R2. We have some room to fudge our numbers at this step, but let's see what happens if we make some assumptions. A value for R2 may be selected in many ways, but the proper way would be to select it to be approximately twice the value of the desired input impedance. There is no real detriment to selecting an R2 value that is too high, except that transistor bias stability may be affected. If R2 is too low, the resulting low input

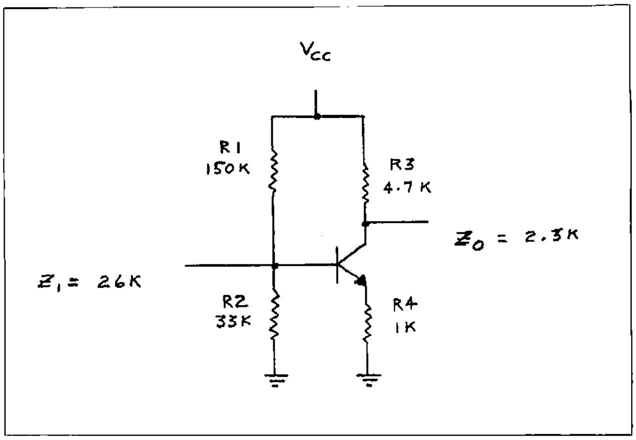

Fig. 1. Completed circuit design based upon the data obtained from the 2N3904 transistor Vce-Ic characteristic curves.

impedance requires more drive power from the preceding stage.

Although the actual ratio of the R2 current-to-base current is not critical, the resulting base bias stability is critical. By rule of thumb, current flowing through resistor R2 should be at least ten times higher than the base current at QOP to maintain stability.

If we follow the rule of thumb and have a QOP base current of 6 μA, then the minimum current through R2 must be 60 μA. We determined previously that the voltage across R2 should be either 1.9 or perhaps 2 volts. Using 2.0 volts divided by 60 μA, we get 33,333 ohms for the value of R2. Knowing that value, you can now fudge it to a standard value either up or down. Our logical choices then fall within the range of 27k to 47k. But to keep things within our calculated region, lets use a 33k value for R2. With 2 V across R2, the current flowing through R2 will be 60.6 μA. Add to that the 6 μA base current and we get 66.6 μA of current flowing through resistor R1. With 12 V Vcc and 2 V across R2, R1 will have 10 V across it and a current flowing through it of 66.6 μA. Dividing 10 by 66.6 μA yields a resistance value of 150,150 ohms. The closest common value is 150k for resistor R1.

OK, where are we in the design of our amplifier stage? We now know the values for resistors R1, R2, and R3, but we haven't determined the value of R4. So how do we determine the value of resistor R4?

Looking at the load line of 4.7k as shown in **Fig. 2**, we locate the 6 μA base current curve. Where the curve intersects with the load line we can determine the collector current to be 1.4 mA. Adding the base-current of 6 μA to 1.4 mA results in a negligible difference, so we'll use 1.4 mA as the current flowing through resistor R4. Earlier, we selected the voltage across R4 to be 1.2V, and with 1.4 mA of current flowing through it, the resistance value would then be 857 ohms. We can then choose a standard resistor value between 560 and 1,000 ohms. Let's choose 1k as a value for R4.

If we've done our math correctly, we should now be able to build up the circuit using the 2N3904 characterized by the curves and have it perform per our calculations. Assuming that we've built up the circuit, what would be a first test to perform on it that would provide an indication of our success or failure? I'd suggest measuring the voltage from collector to ground and from emitter to ground. Since we've done all of the resistor value selections using 1.2 V from emitter to ground, it should be reasonably close (perhaps in the 1.2–1.5 V range) even though we've fudged the figures some. OK, then how should we determine the voltage from collector to ground? Take a look at the load line curves shown in **Fig. 2**. At the 6 μA curve intersection with the 4.7k load line, the voltage is approximately 5.5 V. An actual circuit measurement of the voltage from collector to ground should yield a value reasonably close to 5.5 V.

Now let me make an observation for you that has always been a key for me when designing a stage similar to the one we've used as an example. The collector voltage should be centered approximately at the midway point between Vcc and ground. If Vcc is 12 V, then the collector voltage should be reasonably close to 6 V. If you subtract the emitter voltage of 1.2 V from 12 V you get almost 11 V, and when 11 V is divided by 2 you get 5.5 V, which is a match for what we calculated. The important thing to know is that we've done our selections correctly and that the results are within the ballpark of our calculations.

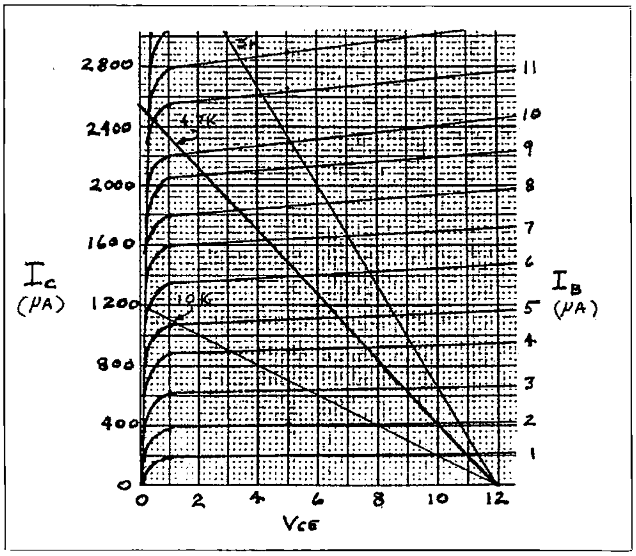

Fig. 2. 2N3904 characteristic curves with three load lines shown.

Input/output impedance

Now that we have the resistor values selected as shown in **Fig. 1**, we can estimate the input and output impedance of our amplifier design.

The output impedance is the simplest to calculate because in setting up the load Line we chose a 4.7 k resistor for R3. We then selected the QOP on the load line to be at the midpoint between zero and Vcc, causing half of Vcc to be dropped across resistor R3 and the other half to be across the transistor. Impedance-wise, the transistor and resistor are equal in value and are

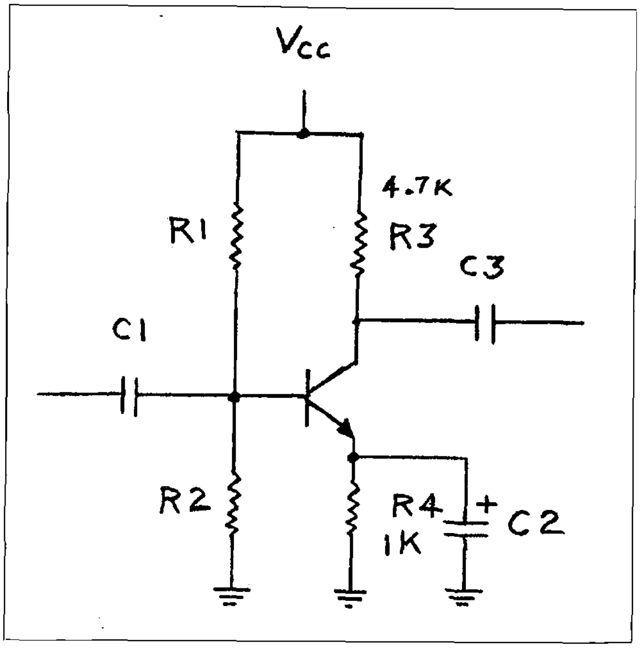

Fig. 3. Adding capacitors to the Class-A amplifier.

connected in parallel. Therefore, two 4.7 k resistors in parallel will yield an output impedance of 2,350 ohms.

Determining the input impedance is a little more difficult, but it can be estimated to be a value between 50%-75% of the R2 resistor value. The wide range of variability is caused by factors in addition to the resistor values involved. Resistor values R1 and R2 used in the circuit establish the maximum input impedance value which can be shifted to a lower value by the reflected resistance/reactance into the base from the emitter.

Let's approach a calculation of the input impedance by considering the factors involving resistors R1, R2, and the reflected impedance from the emitter circuit. If we use the un-bypassed emitter resistor, then the reflected impedance into the base circuit is the transistor gain times the value of R4. In an earlier calculation we determined the stage gain to be 227. We then get 227,000 ohms by multiplying 227 times 1,000 ohms. Placing R1 (150k), R2 (33k) and the base impedance of 227k in parallel, we get a resulting impedance value of 26,169 ohms. A further reduction in the input impedance would occur if a capacitor was placed across resistor R4 — the reactance of the capacitor is a function of frequency as the controlling factor.

Using the amplifier

When using the amplifier as an audio amplifier, it is necessary to consider the lowest frequency of intended operation. Because capacitors exhibit a reactance value as an inverse function of frequency, the reactance value will be the highest at the lowest frequency.

Referring to **Fig. 3**, we have three capacitors to consider to complete the design of our amplifier. Under most circumstances the capacitor values are selected "because they are available" from our "junk box" — and that's OK. However, following the premise of determining how values are selected, we can examine the circuit requirements imposed on the value selection.

In terms of value selection, capacitors CI and C3 are perhaps the most critical from the standpoint that they involve the signal path where an impedance value must be considered for stage coupling. Capacitor CI is the input coupling capacitor and can affect the input impedance value of our amplifier. Our circuit design exhibits an input impedance of 26k ohms, and the reactance of CI should be less than 26k at the lowest frequency of expected operation. When the reactance value of Cl is equal to the 26k ohms, typically half of the input signal will be dropped across Cl and the other half will be

between the base and emitter of the transistor. Dividing the signal equally creates a 3 dB (half power) rolloff in the transferred signal. If we assume the low end of our audio spectrum to be 300 Hz, then we would prefer to have as much signal transferred as possible down to at least 300 Hz. A frequency rolloff below 300 Hz might then be acceptable. As the circuit designer, you have choices to make in the final performance of the design.

If we choose 100 Hz as our 3 dB point, then the capacitive reactance of Cl should be 26k or less at 100Hz. A 0.1 µF capacitor exhibits a reactance of about 24k at 100 Hz; therefore, any capacitor value greater than 0.1 µF will meet our objective. A common capacitor value selected for Cl falls into the 1 to 5 µF range.

Selecting the value of coupling capacitor C3 follows the same thought process except that the reactance value should be equal or less than the 2.3k ohm output impedance value. Again, a 1 to 5 µF capacitor meets the criteria since a 1 µF capacitor exhibits a reactance of approximately 2,400 ohms at 100 Hz.

We must consider the amplifier's gain rolloff when selecting capacitor C2. Before deciding on the value to be selected, let's see what goes on in the emitter circuit. With an un-bypassed emitter resistor, an input signal will cause the current through the transistor to vary, creating an Ic change through both resistors R3 and R4. With the ratio of resistors R3 and R4 being approximately 5 to 1, one fifth of the resulting signal will appear across R4. Of concern is that any signal developed across R4 will subtract from the input signal. This is called de-generation and it reduces the effective gain of the amplifier stage.

The presence of degeneration in our amplifier improves the response linearity of signal amplitude swings at the transistor base. Again, it is your choice to select the amount of degeneration, if desired, that will be used. Placing a bypass capacitor across resistor R4 will reduce the degeneration and will create a higher stage gain, causing the amplifier to exhibit a low frequency rolloff as a function of capacitive reactance.

If bypass capacitor C2 is used, then its reactance value is selected to match the value of R4 at the lowest frequency. Assuming 100 Hz to be the desired rolloff frequency, a 2 µF capacitor would provide a reactance value close to 1,000 ohms. Choosing a common capacitor value of 5 to 10 µF would meet the criteria.

Conclusions

Our amplifier design is now complete with all component values identified and it can now be placed into operation.

I hope that you've had as much fun with the tour as I've had in presenting it. Much of the mystery behind how circuit values are determined should

Continued on page 59

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DTMF Remote Controlling

In somewhat fractured syntax, here's how to let your fingers do the talking.

Editor's note: While the information in this article is pretty much "old hat," we publish it as a gesture of thanks and encouragement to those potential authors around the world for whom reaching us — and thus you — is not as easy as just sticking something in the mailbox or sending an E-mail. Indeed, Shahrokh, like a number of overseas contributors, had to negotiate considerable stumbling blocks in order to legally submit something like this. Their goal? Simply to share information, and, as Shahrokh put it in a letter, "to know more and more by others' help." We thank them all, and hope you do, too. — J.B.

Do you want to be able to control any electrical set just by a call? You have seen the different types of telephone sets, and of course can see how they work and how they dial.

As you know, there are two ways for dialing; we name them "pulse" and "tone." This article will explain these two systems and show how to design and build an inexpensive system which can help you to sit in your armchair at your home or work office and control/command any electrical sets located at any point in the world just by making a telephone call.

Pulse and tone dialing

There are still thousands of old dial-type telephone sets. If you connect the dial telephone's line to an oscilloscope terminal you can see square waves on the screen which show the same number of high/low levels equal to the number you dialed. See **Fig. 1**. This type of telephone is called a "pulse" dialer. On the average, it takes one second for each number dialed. If you dial 6 figures, it takes about 6 seconds. As a result, old telephone centers were slow to dial.

In most countries these days, digital telephone centers are used, and just one of the advantages of these centers is fast dialing by using DTMF, or "tone" dialing.

What is DTMF?

Fig. 2 shows a matrix with four rows and four columns. As you can see, any pressed key can be detected by tracking the two frequencies of the output wave. For example, if output consists of two tones with the frequencies 770 Hz and 1477 Hz, then key number 6 is the one that was pressed.

In tone dialing, the telephone center can detect your dialed numbers with more speed and accuracy than with pulse dialing.

Phase Locked Loops, or PLLs, are the best choice for tracking a signal to measure its frequency. There are several types of PLL devices for general or special purposes, and everyone can choose what type is more efficient for his or her application. In this project you could use the NE567 IC PLL (see **Fig. 3**). It has a TTL output and this characteristic makes it so efficient for designing a simple digital system to decode the numbers. Of course, there

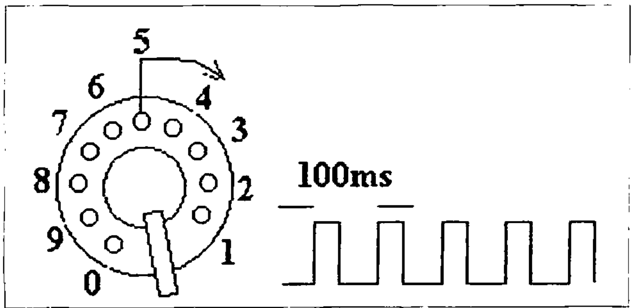

Fig. 1. Pulse dialing.

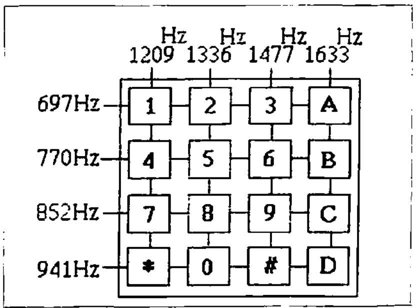

Fig. 2. Tone dial pad.

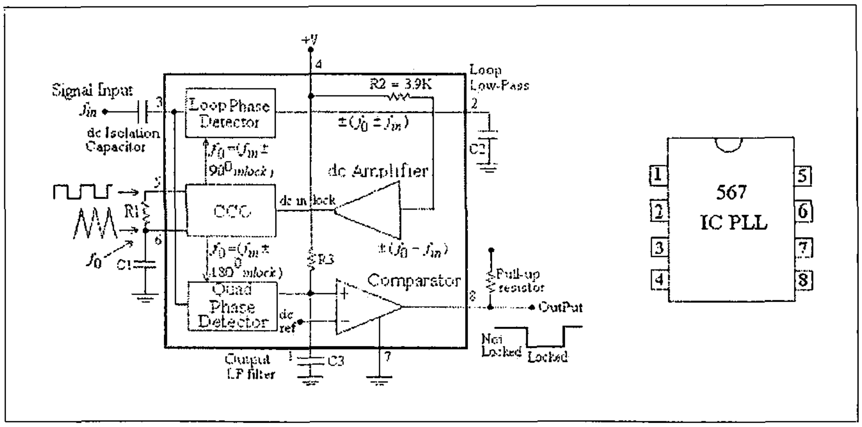

Fig. 3. A sample PLL circuit using IC PLL 567.

are several special ICs which are produced for this application that directly decode the numbers and give four bits support of the 16-key dial pad. In fact, these ICs consist of eight PLLs and a simple decoder to convert the outputs of PLLs to 4-bit words as output. We will use one of these ICs to simplify the project.

The goal

In this project, the goal is to remotely turn electrical systems off and on through making a telephone call. You may be at any point in the world. All you need is a touchtone telephone. (See **Fig. 5**.) We will use your telephone set as the origin of the call and the DTMF remote controller as the destination.

When the ringing signal is detected at B, the DTMF remote controller will virtually pick the telephone up and the system will automatically begin its routine. For instance, it sends you a beep or a recorded voice to notify you about the connections and to offer help with its operation.

Through software, any key or any composition of keys could be specialized to do an exact instruction. You can also do this with the dependent Help/Notify recorded voice.

You can command the system by pressing on the TONE keypad. It is possible to add more capabilities for this system, and you might enjoy programming the software according to your needs.

This article describes the tone decoding and interface circuits. The software is not described because it will vary with the application.

Block diagram, Fig. 4

The Ringing Detector detects a ringing signal and makes a proper interrupt for the microcontroller. Next, both relays are connected to the telephone line, and now the system sends a beep

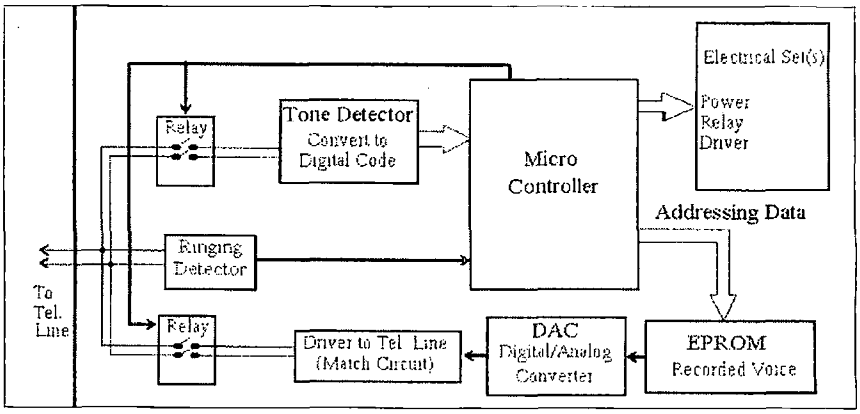

Fig. 4. DTMF remote controller block diagram.

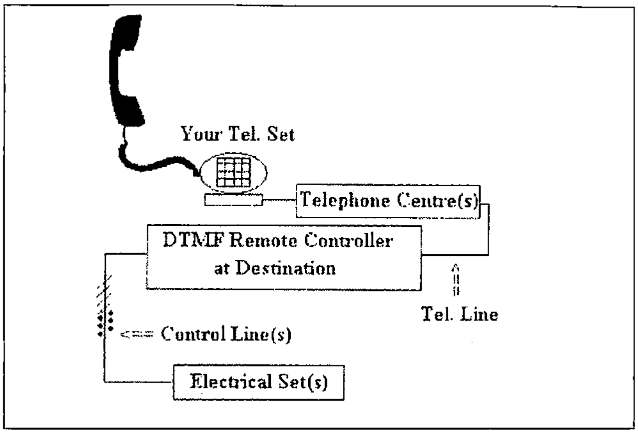

Fig. 5. What's the goal?

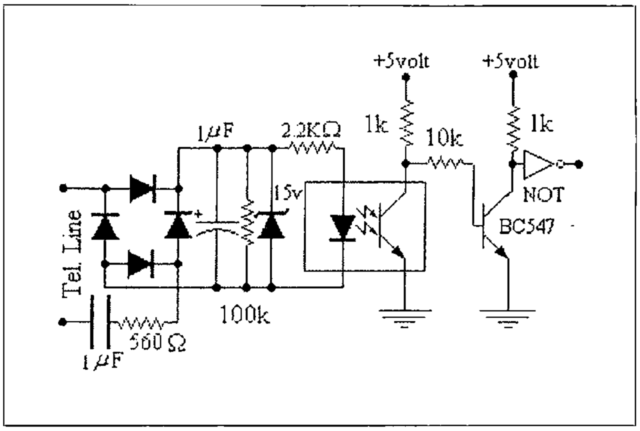

Fig. 6. Ringing detector.

or a voice to show its readiness. The tone detector is ready to convert your commands to digital words and, according to your commands, the microcontroller is ready to do specified routines — for example, turn On/Off some electrical sets which get their power through power relays.

Ringing detector

A ringing signal is a sinusoidal wave with about 100V(p-p) amplitude. This circuit detects received ringing and applies an interrupt signal to the microcontroller/processor (see **Fig. 6**). By using a transistor as a switch, the output will be TTL-compatible.

A rectified ringing signal is applied to an optocoupler device to cause transistor T1 to turn off. As the result, output voltage goes high (level).

TONE detector

Output of the ringing detector is used as interrupt activator of the microcontroller. The software will tell the two relays (see **Fig. 4**) to run (connect). The TONE detector could be an array of 8 separate PLLs, each one is locked in the same frequency of dependent key on keypad. **Fig. 3** shows a sample PLL circuit which uses IC PLL 567.

Of course, in this method it is necessary to decode these 8 outputs to a 4-bit word, and also detect the output changes to recognize the pressed key changes and create a special signal for the controller.

These all take more time and cost, but fortunately there are several different integrated circuits (ICs) which combine these circuits on a single chip.

Continued on page 28

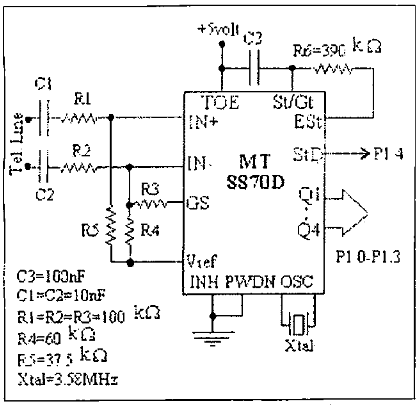

Fig. 7. Pinout connections of MT8870D.

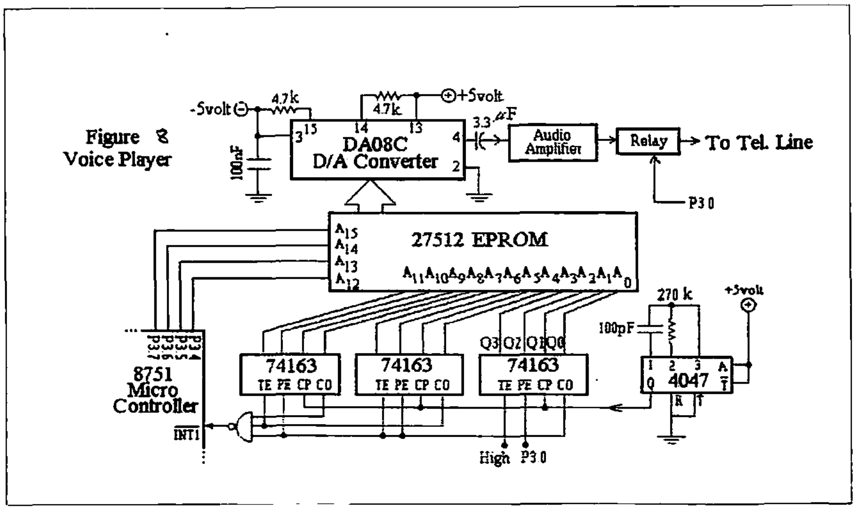

Fig. 8. Voice player.

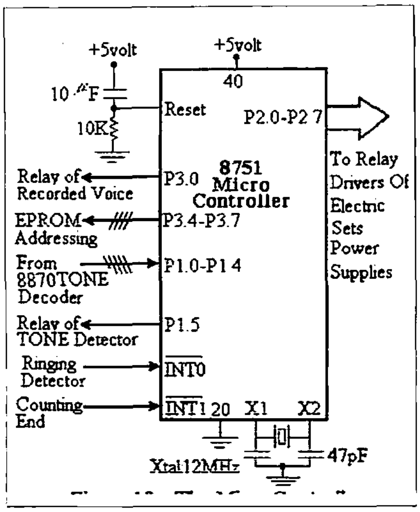

Fig. 10. The microcontroller.

DTMF Remote Controlling

continued from page 27

For example, in this project, the MT8870D (DTMF receiver, manufactured by MITEL Co.) is used because it was the one accessible in Iran. (Available in the U.S. from B.G. Micro, [www.bgmicro.com].)

MT 8870D/8870D-1 integrated DTMF receiver

The DTMF8870D/8870D-1 is a complete DTMF receiver integrating both the band split filter and the digital decoder function. The filter section uses switched capacitor techniques for high and low group filters. The decoder uses digital counting techniques to detect and decode all 16 DTMF tone pairs into a 4-bit code. External component count is minimized by on-chip provision of a differential input amplifier, clock oscillator, and latched three-state bus interface.

Fig. 7 shows a sample pinout connection of MT8870D/MT8870D-1. P1.0 through P1.4 are I/O ports of the 8751 microcontroller.

EPROM (recorded voice)

Here is some information on using a 27512 EPROM to store spoken words. The 27512 is a 64 Kbyte EPROM. See **Table 1**; there are 16 main saved words for sentences of the autoreporter. For example:

System: Ready.
System: Command?
User: 5 [enter] (choose Set number 5)
System: Set Number 5, Command?
User: 1 [enter] (default command for turn on)
System: Number 5, On, Beep.

It is possible to use additional words with additional EPROMs or even using a PC with infinite capability to save words or sentences with EPROM.

64 Kbytes is adequate to save 16 words with a sampling rate of 8 kHz. For simplification of addressing and because of the limitations of microcontroller ports, the duration of all words are equal, 0.5 second each. This duration simplifies the addressing. The microcontroller provides four upper bits (A12–A15) and detects 16 words; the rest lower bits are provided by three cascade counters (see **Fig. 8**). The clock frequency of these three is the same 8 kHz of sampling rate produced by a 4047 astable vibrator.

INT1 shows each word's end. During this period, the output data of

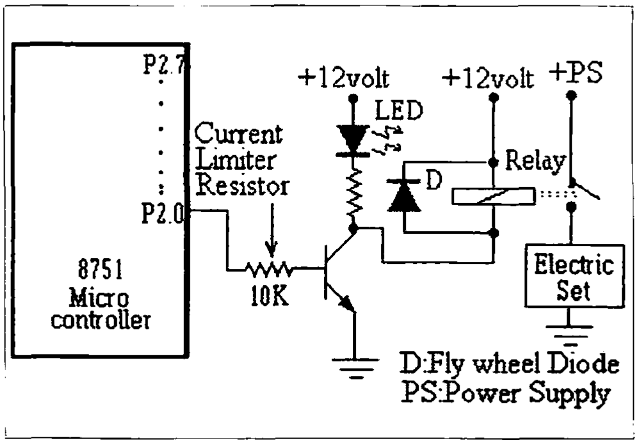

Fig. 9. Relay drivers.

Word	Address	Word	Address
One	0000H-1000H	Set	8000H-9000H
Two	1000H-2000H	On	9000H-A000H
Three	2000H-3000H	Off	A000H-B000H
Four	3000H-4000H	Ready	B000H-C000H
Five	4000H-5000H	Command	C000H-D000H
Six	5000H-6000H	Number	D000H-E000H
Seven	6000H-7000H	PassWord	E000H-F000H
Eight	7000H-8000H	Beep	F000H-0000H

Table 1. Data and addresses of 27512 EPROM.

EPROM will be converted to analog by a DAC, amplified by an amplifier block, and sent to the telephone line.

Relay drivers

As you know, the maximum output current of microcontroller's ports are limited, so for providing the exciter current for relays, I strongly recommend using a transistor as shown in **Fig. 9**.

The microcontroller

The used microcontroller is 8751 with on-chip memory to save the software. **Fig. 10** shows its terminal connections. You must program the microcontroller to perform your desired functions.

References

1. Robert G. Irvin, *Operational Amplifier Characteristics and Applications* (New Jersey: Prentice-Hall Inc., 1987), p. 357.
2. *CMOS Pocket Guide* (GTP Ltd., 1991), p. 69.
3. *TTL Pocket Guide* (GTP Ltd., 1991), p. 1–164.

***

Shahrokh Sanati was born in Tehran Iran in 1976. He received an engineering degree (B.Eng.) in electronics from the Ferdowsi University of Mashhad in 1999. He is interested in all things relating to electronics and computers, and is interested in feedback from others to help him learn more. He is not a member of any amateur radio society because no real societies exist in his country at the present time.

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The QRP Asylum That Almost Closed

The mad building spree continues.

After more than a year of building QRP rigs, I have them piled everywhere. My shack has a shelf-full, and I have them in my upstairs office and several on my bedside table. I even ran a coax up along the main plumbing vent stack from the basement to the attic so I would have an antenna feed on the second floor.

About a month ago, I noticed that none of the rigs upstairs worked very well. With simple receivers, you can never be sure if the band is down, or there is a source of interference that is masking the signals. First my 80m receiver started getting very faint. Then the 20-meter rig went deaf, and then my Small Wonder Labs SW+ 40m transceiver stopped hearing anything. Maybe I misplaced my good high-impedance earphone? Those rigs don't drive inexpensive 8-ohm stereo headphones very well, do they?

Photo A. The coax balun on my G5RV dipole.

How was it that radios which checked out perfectly down in the shop just faded away upstairs? The coax switch was set properly, and the connections looked good from a distance. Why am I bothering with these homebuilt rigs anymore? Why not just save up for an Icom 706 or one of those new FT-817s or even a TS-50?

The mystery was solved right after I put up my first decent HF antenna in 15 years.

The MFJ G5RV ($39.95)

I used to move a lot for work, and did not like the idea of putting up a tower and then selling the house and taking down the tower a year later. As a result I was running dipoles and verticals. The dipoles were never high enough (20 feet or so) and the verticals never had enough buried radials. The result was that I got lousy signal reports and enjoyed plenty of frustration. When testing a recent 80-meter transmitter project, I got a generous 339 report from a ham a mile away.

I had been pacing out my backyard for several years and eyeballing a 50-foot oak tree right behind the house. What if I put up a dipole here? How would I ever get a line up there? I was sure that the wire would break as the tree limbs bent in the wind, so I never took any action.

One day I got fed up and went up to

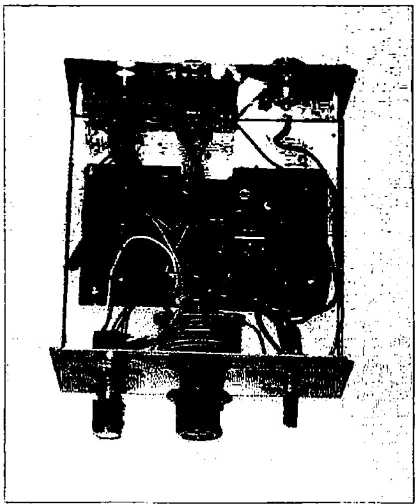

Photo B. W1FB 40m 1.5 watt transceiver kit, top view.

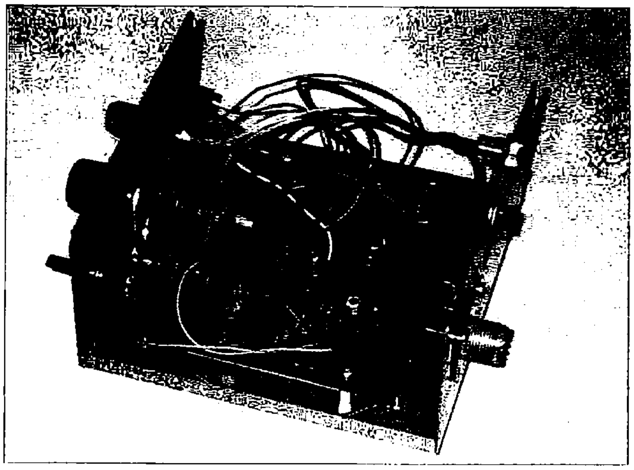

Photo C. W1FB 40m 1.5 watt transceiver kit, side view.

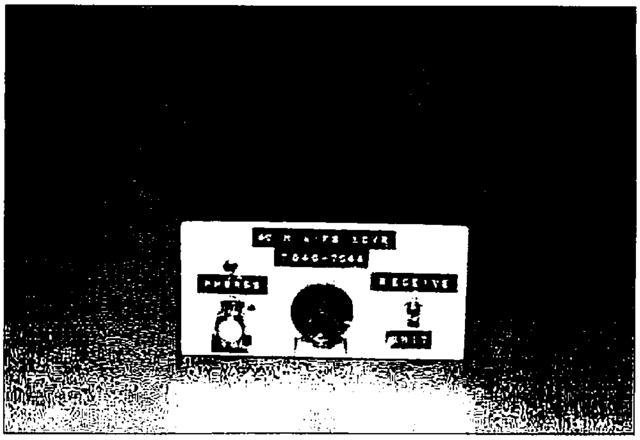

Photo D. W1FB 40m 1.5 watt transceiver kit, all finished and ready to run.

Radio City. I was pondering yet another compromise HF antenna, a Hamstick Dipole. Then I checked the selection of wire dipoles. They were sold out of the various shortened dipole kits. But they did have a G5RV left. It was 102 feet long and used ladder line. I wondered if it would fit in the yard. What would I do with ladder line? As with all impulse buys, I'd take it home and I'd make it work.

In the garage was a child's fishing rod I'd salvaged from a dumpster. My fishing tackle box contributed a one-ounce sinker that had done walleye duty on Lake Mille Lacs. I went to the rooftop, and looked over at the tree, which was now eye-level. The first cast went over the top. I said no, I wanted to go over a certain stout limb most of the way up. Another cast and the line got tangled. Forget it — over the top again. I got out a hank of green 1/4-inch nylon antenna rope, and hoisted the center point of the G5RV. The bottom of the 35 feet of attached ladder line was dangling 10 feet in the air. This meant the center point was up over 45 feet!

Down in the shack, I tuned up my main HF rig on 80 meters. Smoke came pouring from the tuner. Was that coax balun supposed to be 7 turns or 10? Back outside to add a few more turns. My 80-meter SSB section net was starting — I asked for a report. Instead of the usual "try again, you are just above the noise," I was 58/59, even 10 over 9!!! In the course of running the coax for this antenna, I found that the jumper for my upstairs coax feed didn't go anyplace and ended in an empty connector.

The W1FB 1.5 Watt 40-Meter CW Transceiver

I think I've said this before — if you have a bit of money and a credit card and want a great low-cost QRP transceiver kit, order up a Small Wonder Labs SW+. This is almost too easy, though. There is a thrill to the chase in seeing how far you can get rummaging in the junk box to scratch-build something more basic.

FAR Circuits makes the PC board for the W1FB transceiver from the *W1FB Design Notebook.* The one tricky part is the audio transformer — the board is set up for the Mouser part, though you can use a substitute. FAR includes a circuit board layout addendum dated 3/90. There are a few typos to watch for:

On the FAR sheet C10 has the wrong polarity. The schematic and book layout are correct. In the book on p. 169, the lower-left 0.1 µF cap should say C33 not C23. In the caption on p. 167 it says, "T1 has 28 Ts no. 26 enamel." That should say T3.

The main RF transformer in the receiver, T1, is a little complicated to install. I colored one of the secondary windings with a black marker before winding it so I would not get it mixed up. I could not get the sidetone part of the circuit to run, and needed to start troubleshooting.

I ended up using a 2N3866 transistor for the PA. I started out with a transistor that looked like a 2SC799 in the distinctive tabbed TO-5 case from an old CB, but I could not find it in my substitution book and it would not work.

My rig tends to operate in a range a few kilohertz above the crystal frequency, so if you want to operate above and below 7040 kHz, you should use maybe a 7037 kHz crystal. I am currently using the $5 7040 kHz crystal that the nice folks at Norcal sell. Thanks, Doug and Norcal.

You can get a 100 pF tuning cap suitable for a knob at RF Parts or Dan's. I found mine at a hamfest. 40-meter CW is no picnic these days with a simple homemade rig. This one seems to have a sweet spot of about 1/4 of the tuning radius on the control. I waited until the band was mostly dead one morning and answered W5HW's CQ, and was able to chat for a bit until the band faded completely.

The Ramsey DMM240 LCR Meter ($99.00)

One of the myths of QRP construction is that you need a bench full of costly test equipment. You can get a long way with just a volt ohmmeter and another HF rig to listen to your signals and generate test signals for receivers. Actually, an outdoor antenna and your fellow hams are a good source of test signals as well.

The Ramsey DMM240 LCR meter is unique in the world of low-cost

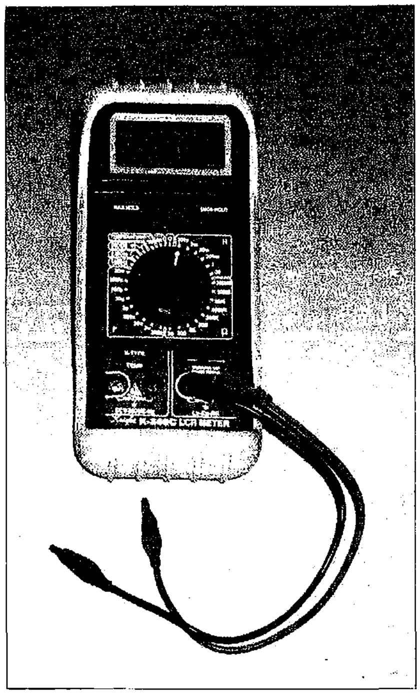

Photo E. Ramsey DMM240 LCR meter.

handheld digital meters in that it has low-value capacitance and inductance scales. These are great for testing and adjusting mystery RF chokes and coils, and for identifying hamfest tuning and trimmer capacitors. It also has a 15 MHz frequency counter that can be used for testing local oscillators, VFOs, and transmitters. If I am feeling unlucky, I test each capacitor, resistor, and coil as I install it, ruling out bad components.

The Wavetek 3000 Series RF Signal Generators ($350 used)

Don Rice NØBVE was kind enough to loan me one of these while I was wrestling with a repeater project. I was immediately addicted, and had to own one. These have thumbwheel switches for setting the exact frequency out to several decimal places. It has a step attenuator, so you can generate an exact number of microvolts of signal to test a receiver. It has two different settings for audio tones, so you can find your signal in a clutter. When you are checking band edges, close does not count, so this one is it.

These cost around $350 in "guaranteed to work" condition on the Internet auction sites. For $175 you can get one "as-is," or "untested." After quite a few radio and test equipment purchases on an auction site, I can assure you that "untested" or "as-is," means "probably broken." You should never assume a piece of equipment is working if it is sold untested or as-is, and you should limit how much you pay for such items to include a significant repair cost.

I bought a 3000 as-is for $175.00, and it was broken. I found that one of the modules inside that did the FM was pulling the -18 volt power supply to ground. I bought another unit as-is for $175.00, and was fortunate to find that one, while also broken, had a good FM module, and the modules were interchangeable between models. I would have saved a lot of time and energy buying one guaranteed to work.

TV service shop inventories

Up at the Superior WI hamfest I was digging around for parts for the W1FB transceiver project above. One of the tables had a row of cartons full of envelopes containing the entire transistor inventory from a defunct TV repair shop. I could not remember what numbers I needed. I bought one of the boxes, and then went back for another and another. Fifty dollars later I had the whole set. When I got home I realized I had most of the 2S line of transistors from 2SA to 2SK, inclusive. There were dozens and dozens of CB output (QRP output) transistors, which cost $4 to $10 each. I made a similar purchase a few weeks later — a guy was selling some of those big service kits of tubes — I could not remember which ones I needed, so got the whole box. W1FB suggests bringing a gunny sack to hamfests and buying ahead. I recommend a pickup truck.

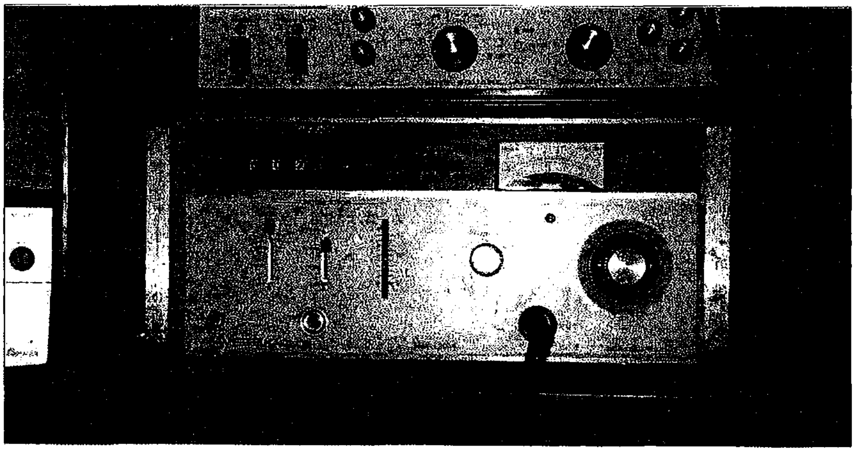

Photo F. The Wavetek 3000 RF Signal Generator.

Old televisions

One night on our Minneapolis Area Tuesday Tech Talk net, Jim Fisk KCØHEW offered up some old television sets for my QRP stockpile. I took the truck to his house and we headed for the basement. He had five or six 18" TVs and some other items. One of the TVs was tube, and I was happy for the tubes, high voltage caps, and transformers. The solid state TVs were heavy and only had a few small circuit boards each. One 9" portable TV had a lot of great components, as did an ancient VCR. Looking at my garage after this trip, I think there is truth to David Newkirk WJ1Z's comment: "Asking around on the air may net you more offers of freebies than you can handle."

References and sources

Dan's Small Parts and Kits, Box 3634, Missoula, MT 59806-3634; (406) 258-2782; [http://www.fix.net/~jparker/dans.html].

DeMaw, Doug, *W1FB's Design Notebook,* ARRL, First Edition, Second Printing, 1994. ISBN 0-87259-320-7.

FAR Circuits, 18N640 Field Court, Dundee IL 60118. (847) 836-9148 voice/fax. Boards and matching article reprints. [http://169.207.3.68/~farcir/index.htm]

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Cleanin' and Climbin'

Hams get involved again.

Whenever there is an activity of more than just a few people, hams are usually requested to provide communications for the event. The event this time was named "Clean And Climb," which was primarily a rock climber's activity with hams providing communications support.

The participating hams had a lot of fun being part of the affair since most of us had never previously been involved in rock climbing activities. For this event, the Xerox Amateur Radio Club (XAR) was asked to provide communications support. Hams participating in the event were (**Photo A**): Barbara WA6EUB, author Hugh W6WTU, Terry KC6VCL, Norm K6YPD, Doug WA6LXB, and Dave W6MIK.

The site selected for the activity was an area called Stoney Point Park located near the northern edge of Chatsworth, California. The County of Los Angeles has marked this area as a "park" so that it appears on the map. Although there are residential communities nearby, the Stoney Point area is made up of huge piles of sandstone rock that appear a lot like huge boulders stacked into various piles that extend upwards perhaps 500–600 feet (see **Photo B**). The area is part of the natural surrounding mountainous environment where the rainfall over time has washed out all of the top soil, exposing the rock structure. The particular pile of rocks selected for the climbing site is isolated from the other piles so that it has become a real challenge for rock climbers. Some of the rock faces are absolutely smooth vertical surfaces standing several hundred feet high. Some rocks form mantles

Photo A. Hams participating in the Clean and Climb activity [L to R]: Terry KC6VCL, Doug WA6LXB, Dave W6MIK, Barbara WA6EUB, Hugh W6WTU, Norm K6YPD. The communications center gazebo is visible in the background.

Photo B. Stoney Point Park. Large sandstone rock formation that is used extensively by rock climbers. The height is estimated to be 500–600 feet.

requiring the climber to crawl up the face below the mantle and then climb over the mantle's edge to get above it for the next challenge.

Fig. 1. General layout of Stoney Point Park. The location of the staging area and contest sites are shown.

The drawing shown in **Fig. 1** depicts the general layout of the rock pile, in addition to showing the location of the various climbing contests. Paths around the rock pile provide nearly 360 degrees of access around the rock that has a circumference of perhaps two to three miles.

Activities for the day started at approximately 6 a.m., with nearly 75 people showing up to participate in the cleanup portion of the event. The hams arrived at 10 a.m. and set up a sun shade, called a gazebo, which was a plastic sheet draped over a steel tube tent frame (see **Photo A**). Four corners of the frame and plastic were staked to the ground, providing a perfect sunshade without inhibiting air flow. A card table was set up under the cover, providing space for radio gear. It also served as the hams' luncheon table.

Lunch was served at 12 noon and consisted of three 6-foot-long Subway-style sandwiches cut into 3-inch sections. Each was about 6x4 inches in diameter. A single 3-inch slice was about all one can get around and still feel as if they could navigate. An excellent-tasting potato salad was provided, along with potato chips, salt-free trail mix nuts with raisins, soft drinks, and water. It only took one trip through the chow line to get filled up, so there was ample food available at the end of the day. At that time it became "open season" on the remaining food, as it all had to "go" in the end.

Following lunch, the activity judges were brought over to the communications center gazebo where a ham operator was paired off with a judge. There were six hams and six activities

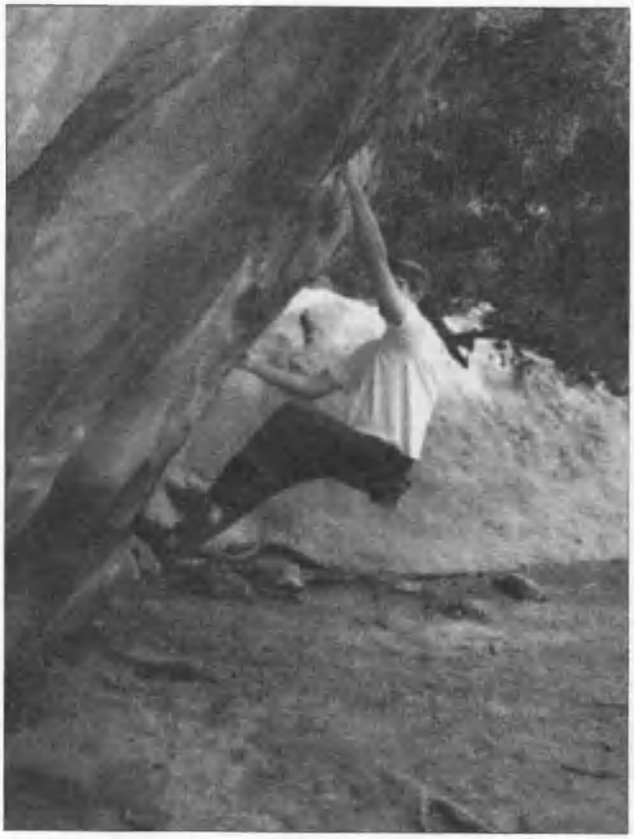

***Photo C.** Mantle climb. One of the easier contest climbs.*

***Photo D.** Boulder climb. Of the contest sites, this climb was considered to be the most difficult.*

which worked out well. Barbara WA6EUB manned the communications center with a handheld while the rest of us followed a judge to a designated contest location. Being the fortunate one with a site only a few hundred yards from the communications center. I was able to carry a folding chair along with my radio gear.

Communications around the area worked reasonably well using handheld radios on a simplex frequency in the 450 MHz band. An exception was one site located on the far side of the rock pile where periodically a communication relay was required. Most of the time, direct communications worked very well. The actual communication content was very informal and related the location of the teams, team completion at an event, and "Hey, where are you?" Fortunately, there were no injuries or accidents during the event, but had there been, the hams were prepared to alert medical services.

Cleanup of the area, though not complete, yielded 110 gallons of glass along with roughly 2,000 pounds of trash and metal. All was accumulated, separated, and placed into plastic trash bags for disposal. Included was a bent up automobile hood and a steel bumper.

Of the 75 persons involved in the cleanup activity, only twenty participated in the climbing contests. The twenty were broken up into teams of four persons each and given a team number. For single person activities, one team member would do an assigned task with a different member for each contest. The strategy was to prevent the strongest or most skilled team member from dominating the contest. Multiple person tasks required all team members to participate. Points were assigned by the site judge based upon the team's ability to complete the task and the "fun" exhibited by the team. Some tasks such as the hide and seek, and relay climb were graded upon the number of tries, time required, or speed of completion. During the speed/timed contests, a designated chip was to be retrieved and returned to ground level. If the incorrect chip was retrieved the "wrong" chip had to be returned to the found location and the correct chip brought down to the judge.

There were five contests provided for the climbers. Each is outlined below along with a photo showing essentially what was expected of the team members. A photo for the relay contest was not available.

Mantle: One team member from each team was required to grasp the rock face using bare hands. The task was to climb up and over the face of the mantle (**Photo C**). Hugh W6WTU was stationed at this event.

Boulder: This was a large smooth faced rock that was considered to be the most difficult contest of all. Of the five teams, only one member from each team was allowed to climb. The objective was to climb and stand on top in the shortest amount of time. Only one person was successful in completing the boulder climb (**Photo D**). Dave W6MIK observed this event.

Blind Climb: For this event, the selected team climber was blindfolded. To assist the climber, two team members

Continued on page 59

Photo E. Blind climb. Climbers were blindfolded for this contest. Other team members functioned as coaches.

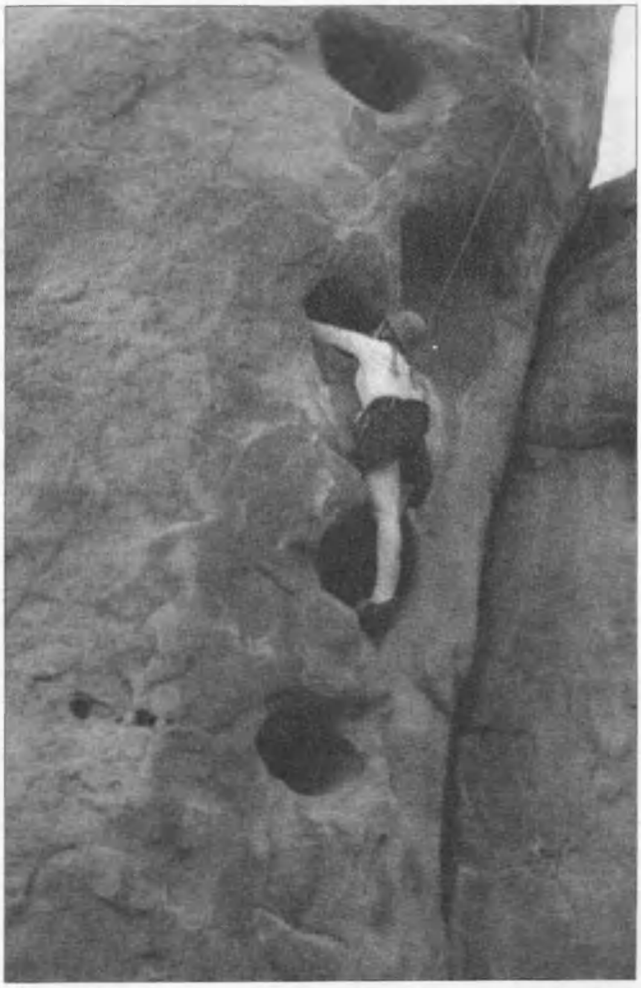

Photo F. Hide and seek. Team identifier chips were placed at random in three of the holes. The correct chip had to be retrieved within the shortest time period.

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Bear Island on the Air

Don't forget to use your antenna duner.

"Beep ... beep ... beep." It seemed like I had just gone to bed, and the clock was already going off. It was 4:30 a.m. on Saturday, May 19th, and I knew that adventure lay ahead.

I was one of three hams going on a sea kayaking QRP expedition to Bear Island off the coast of North Carolina. Bear Island is unique, having dunes that are over 100 feet high. Most of the islands in North Carolina that have high dunes are off the northern coast of the state. Bear Island, part of Hammocks Beach State Park, is approximately 4 miles long, half a mile wide, and has no development or roads, with the exception of a shelter built for the park rangers.

I had packed the car the night before, so after filling my water bottles and getting the food together, all that was between me and a weekend of hamming was the three-hour drive to Swansboro NC, where we would be renting the kayaks. Once I arrived, I met up with the two other adventurers. Paul AA4XX of Raleigh is an experienced kayaker as well as an accomplished QRP operator who lives for microwatting. John WB4OFT, of Greensboro, was new to kayaking, but also was an experienced QRPer. Paul and John had arrived a couple of days earlier — Paul to get an extra night of camping on the island, and John to take some safety classes. We are all members of the Knightlites QRP group based in Raleigh.

Getting to the island was an adventure in itself. We had to wait for a break in the boat traffic before we could cross the Intracoastal Waterway. The trip involved navigating through two and a half miles of channels between

Photo A. Chris KD4PBJ (left) and John WB4OFT at kayak rental shop in Swansboro NC. Intracoastal Waterway behind. (All photos by Paul Stroud AA4XX)

Photo B. Arrival — note small antenna tuning unit below black section of mast.

Photo C. *WB4OFT walks through campsite.*

Photo D. *Campsite, Atlantic in rear. One group of boaters we met asked what kind of fish we hoped to catch. The "poles" were really our half-wave verticals. Telescoping masts by Kanga weighed less than three pounds each.*

grass-covered sand bars. We would often get down a channel only to have Paul, who went slightly ahead of us and acted as our guide, come back to tell us that our path was a dead end. Low tide complicated this journey even further, making channels that were 4 feet deep during high tide only 6 inches deep. After three hours we finally made it to the island.

Paul had come out the night before and already set up his tent and the antennas that we were going to use, two half-wave verticals. He had purchased 30-ft. extendible fiberglass poles from Kanga, and attached a wire to the top of each. The wire came down to a tuning box at the base of each pole, where a short length of RG-174 coax went to a homemade phasing control and was connected to our rig, a White Mountain 20-meter QRP SSB radio. We were set up less than 20 feet from the ocean, facing a large sound. Paul had tested the antennas earlier and found them to work just as well without radials as with them, so we did not bother to put out any.

The first contact that I made was with a special event station in White River Junction VT. They were a solid 5-9, and returned a 5-5 for me. They were sure amazed when we gave them our power level ... 2 watts! We would answer CQs and usually be acknowledged within three tries. The countries worked this weekend include St. Vincent, Germany, England, Lebanon, Canada, Denmark, Brazil, Russia, Belarus, and Kuwait ... all on single sideband with 2 watts and all with home-brew antennas, a kit-built rig and a 7 amp-hour gel cell battery!

Continued on page 61

Photo E. *KD4PBJ at the mike.*

Photo F. *The station: home-made antenna phasing box (top), White Mountain 20m SSB rig, and 7 amp-hour, 12 V battery in rear.*

QRX

continued from page 7

there was only a very short time to get ready for the April 15, 2000, changes, but the VECs and VEs pulled off a miracle. As a result, there was no interruption in testing when restructuring was put in place.

But miracles are not commonplace. It takes hard work to keep the all volunteer testing system in operation. And Creel says that's where you come in.

If you have any ideas on how to improve the system in general and the situation in Alaska in particular, John asks that you please contact him. He prefers E-mail. His address is [creewb3gxw@aol.com].

Who is John Creel WB3GXW?

By way of background, Creel, first licensed in 1977, holds an Extra Class amateur license. His mother, wife, and both daughters are also amateurs. He is a life member of the American Radio Relay League and in 1998 was named the Atlantic Division Amateur of the year.

Creel started volunteering with the Laurel VEC program in the spring of 1989. Since 1990, his VE has tested over 3,000 applicants. WB3GXW started attending VEC conferences in 1991.

But that's not all. As an ARRL Official Bulletin Station, Creel owns and operates the only area repeater that retransmits the Amateur Radio Newsline, the ARRL audio news, and This Week in Amateur Radio. This, on Saturday and Sunday nights starting at 8:00 p.m. on the Silver Spring MD 147.225 MHz repeater that bears his callsign.

The bottom line is that John Creel WB3GXW is a very involved member of our ham radio fraternity who is now taking on another challenge.

Thanks to Newsline, *Bill Pasternak WA6ITF, editor.*

A Truly Old Message

Here's a story about communications of a different sort. About paper, pencil, a bottle, and the sea. We have all heard the stories of survivors of shipwrecks washing up on an island. Eventually, they put a message in a bottle and toss it out to sea in the hope it will be found and they will be rescued.

Well, not all messages in bottles are emergency messages. And now, 45 years after it was thrown from a ship into the Indian Ocean, a bottle with a message has turned up in New Zealand. And amazingly, not far from the home of the author.

Austrian Hans Schwarz, now 67, wrote the message in English and German while sailing to Australia in 1956 to attend the Melbourne Olympics. Amazingly, the four-decade-old note was found by a man living about 40 miles north of the city of Wellington, which is where Schwarz now lives.

Where it was found and the contents of the message have not been revealed because the finder, who was not named, has signed an exclusive media deal, the newspaper reported. Schwarz, who got a phone call from the finder, was surprised that the bottle turned up at all, particularly since he had dispatched the message without realizing that the continent of Australia lay between his ship and the Pacific.

Schwarz says that he visited New Zealand after the 1956 Olympics and then returned to Austria. Five years later, he headed back permanently to Kiwi-land, saying he missed the "easy-going" lifestyle Down Under.

Thanks to The Worldwide Sailor E-Newsletter, *via* Newsline, *Bill Pasternak WA6ITF, editor.*

Guitarist Chet Atkins W4CGP — SK

Chet Atkins, whose guitar style influenced several generations of county and rock musicians, died Saturday, June 30th, at his home in Nashville TN after a long battle with cancer. He was 77.

Chet was born Chester Burton Atkins on June 20, 1924, on a farm in Luttrell TN some 20 miles northeast of Knoxville. While his brother urged him to learn to play the fiddle, Chet took a fondness to the guitar early on. According to his Internet biography, at the age of nine, he traded a pistol for a guitar.

Atkins learned rapidly, becoming an accomplished player by the time he left high school in 1941. Using a variety of contacts, his first professional job was on WNOX, where his boss was the legendary singer Bill Carlisle. During the 1940s, Atkins toured with many acts, including Red Foley, The Carter Family, and Kitty Wells. RCA executive Steve Sholes took Atkins on as a protégé in the 1950s, using him as the house guitarist on recording sessions. RCA began issuing instrumental albums by Atkins in 1953.

During his long and illustrious career, Chet Atkins recorded more than 75 albums of guitar instrumentals and sold more than 75 million records. He played on hundreds of hit recordings, including Elvis Presley's "Heartbreak Hotel" and the Everly Brothers' "Wake Up, Little Susie." But it was not until 1988, when the American Radio Relay League released its promotional video *The New World of Amateur Radio,* that most of ham radio learned that the world's greatest guitar picker was also one of them: "Hello, I'm Chet Atkins. You probably know me as a guitarist, but I'm also an amateur radio operator. I have been for over 20 years and my call is WA4CZD."

Later, in 1991, Atkins supplied the closing theme for another amateur radio video. This one was the joint ARRL and AMSAT production of Ham Radio in Space. And it was only recently that Atkins made use of the vanity callsign system. The call he chose, W4CGP, is almost certainly based on the words of radio host Garrison Keillor, who wrote the liner notes for the album *Chet Atkins, CGP.* To quote Keillor: "Whenever Chet Atkins picks up a guitar and plays, you see all the other guitarists in the room lean forward and smile.

There is something so emotional, so clear, so purely lovely in this man's music. And if you have ever picked up a guitar yourself you are even more touched by him. That's what makes Chet a Certified Guitar Player — CGP. It's your peers who certify you, and he is admired and loved by the ones who knew him best."

Chet Atkins' funeral was held Tuesday, July 3rd, at Nashville's Ryman Auditorium, the former home of the Grand Ol' Opry. He is survived by his wife of more than 50 years, Leona Johnson Atkins. 73

Never Say Die

continued from page 4

repair any piece of electronic equipment the navy had. No memorization. No exams. No homework. We had fun and it was exciting. We learned how every piece of equipment worked...radio, sonar, radar, and oscilloscopes. First came the chalk and talk on the theory. Followed by an exam? No way. Followed by a laboratory full of fiendishly disabled equipment. Wow, was that fun! What a challenge! And you had to understand how a piece of equipment worked to fix it.

Our present public school and college systems are based on the fear and punishment system of teaching, so it's naturally doomed to fail. It sure isn't fun, and no kid taking a course in algebra will be found in Barnes & Noble looking for more books on the subject. Ditto trigonometry. After sixteen years of endless punishment it's no wonder so few people have any interest in educating themselves once they're out of school and have a certificate saying they are now educated. What a crock.

It's no wonder that virtually all of our most successful entrepreneurs are either college dropouts, or never bothered to go.

It's also no wonder that Congress had to pass a law forcing children to go to these schools or be taken away from their parents.

Time Spills the Beans!

The 2/5/01 issue of *Time* had a seven-page article on health that was a breakthrough. Of course half of the article was taken up with huge, largely irrelevant illustrations, as usual. The article title was "Repairing The Damage." The subheading read, "Ready to turn your life around? It's simple. Eat right. Quit smoking. Get

fit. Watch your weight. Drink less. And take it easy. Think it's too late to reverse a lifetime of bad habits? The latest research will surprise you."

Hey, isn't that just what I've been preaching?

My *Secret Guide to Health* has essentially the same prescription for repairing the damage you've done, except that I go into the gory details of what eating right means. To pizza and burger addicts it's a very rough transition. Ditto to Coke, Pepsi and Dr. Pooper addicts, who need the temporary lift a huge shot of sugar, caffeine, and a little dissolved aluminum from the can (brain food) provide several times a day.

None of my health prescription is just my advice, I back up every aspect of your needed lifestyle change with solid research references.

Yes, it's tough to take a half hour off from your very busy day just to get out there and fast walk, also getting those needed UVs into your eyeballs. And waste a half hour a day listening to good music just to relax for a while? There's too much that needs to be done. Like watch dysfunctional black families screaming at each other on the court shows. Or some millionaires tussling with other millionaires to get a ball into a hoop, over a goal line or over the fence.

Since most people are convinced they're indestructible, the likelihood that the *Time* article got many people to change their destructive lifestyles is remote. Mother Nature, a.k.a. Big Daddy up there, has to smite you a good one to wake you up. Then, reflexively, you head for your doctor and will be taking his prescriptions for what little is left of your life — thus helping him get all-expense paid vacations to some great places.

Of course, the bright side is that the first warning of a heart attack for 60% of us is death. Well, we sure save a fortune in pharmaceuticals and hospital visits that way. and an awful lot of worry.

Being practical, we don't want to put 90% of our hospitals out of business, nor 100% of our nursing homes and assisted care facilities, right? So, do you want fries with that Big Mac?

Major Bummer

One of my readers recommended that I read *Your Are Being Lied To*, "The Disinformation Guide to Media Distortion, Historical Whitewashes and Cultural Myths." It's a whopper of a book — 9x12 inches and 400 pages ($20). It's new, too — © March 2001. It's a collection of the work of dozens of well-known authors, and talk about iconoclasts, this book shatters many of the myths most of us have been brainwashed by the media into believing. Just the kind of book I love.

Naturally, the first thing I did was to run down the table of contents. Whoa! On page 272, "The Truth About Jesus." Hey, they're not going to mess with Big Guy Junior, are they?

Having been brought up going to Sunday school at the Dutch Reformed Church ever since before I can remember, I was steeped from at least three years old in Jesus' wonders. Now, comes this article, which makes an excellent case for Jesus having been an invention of the early Christian church. I won't go into the details — mostly to keep true-believers from arguing with *me*. Argue with the author and let me know who wins. Warning, this guy really knows his scripture, so if you are a true-believer in Christ, it's best you avoid this article.

Hint: it blows the virgin birth, star of Bethlehem, the manger, the magi, and all of Jesus's miracles out of the water. And it *is* curious that *none* of the historians of that time and area make even one mention of Christ.

The authors do a wonderful job of smashing one belief after another. You'll be driving your family and friends crazy.

Mad Wayne

Anyone who wants to deprogram the religious beliefs of the entire world surely is mad. Anyone who wants to put the world's pharmaceutical industries out of business is obviously crazy.

Talk about a mad revolutionary, I sure fit the bill — only the bomb I'm throwing is printed on paper.

I want to destroy much of civilization as we know it. I want to put our giant food industry out of business. I want to put our school system out of business, including our universities as they are today. I want to put 90% of our hospitals and 100% of our nursing homes out of business. And around at least 80% of our insurance industry. And 90% of our government industry. I want to destroy the politician industry. I want to wipe out the oil, coal, natural gas, and electric companies. Out of this mass destruction of almost everything we have been brainwashed to believe in I want to build a utopia where there is no sickness or poverty — where even a person who never makes more than the minimum wage can retire with a million bucks (read the book by Genetski).

My Utopian Vision

The world of 2020 can be one where 90% of the people live into their hundreds, where there is little sickness, disease or poverty. Where everyone is a genius compared to today, with IQs 50 points higher than now. Where the food supply is grown on remineralized land with no need for pesticides, and where crop yields are ten times what they are today. Schools and universities will have largely been replaced by small DVD players and the inexpensive availability of thousands of DVD programs which are so much fun that everyone is into life long learning.

Schools will mainly be fitted with the equipment needed to help people learn skills, with the classrooms and teachers of today as much of a relic as the one-room schoolhouse of a hundred years ago.

Pollution-free energy will cost a tenth of today's oil and coal, with each building powered by a small cold fusion generator. No more electric companies or power lines.

The "media" will be more into educating us than entertaining us with the troubles of dysfunctional black families. With a new crop of geniuses to write and produce programs, entertainment will as different in the future as today's entertainment is from a hundred years ago — where families gathered in the living room and sang around the player piano or played games under kerosene lamps.

Imagine 2020

A magazine publisher would need have no employees. No salaries. No unemployment insurance. No withholding for the IRS. No medical insurance. No offices. All of the work would be done by independent contracting small companies. Entrepreneurs. They would handle the advertising sales, the promotion, writing, editing, photography, artwork, subscriptions, fulfillment, production and so on, all from their home offices — or even their RVs, as they drive around the country — or any other country.

Mothers would be able, as they should, to nurse their babies for two or more years as they handle subscriptions that come in via the Internet, telephone, mail or fax. The magazine data base would be instantly available anywhere via the Web and satellites. Print and mail magazines? When they can be downloaded daily, weekly or monthly at the customer's demand via the Web and printed out in their homes on inexpensive color printers — or, more likely, downloaded to a DVD to be viewed on a laptop or a big TV screen. That would cut out at least half the cost of publishing magazines right there. No huge presses that have to be run 24/7 just to pay for themselves. No paper by the huge roll. No postage.

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SK Night — the REAL Meaning!

This guy is pretty spooky.

I guess that you're one of those hams who have been thinking all along that "SK Night" is an event happening in early January, when only "straight keys" are supposed to be used. Well, while there's nothing wrong with the idea, it wasn't the REAL beginning of SK Night!

Way back on October 31st, many years ago to be almost exact, when radio was in its infancy, SK Night was slowly evolving into an annual event! And it had nothing to do with January!

Remember, as a kid, turning on the Philco in the living room on a cool October evening? Remember the crackles and pops coming from the speaker as the unit warmed up? The smell of the dust littered the air as the tubes heated up. Static crashes, and weird screeches made "goose bumps" on your skin.

Yep, sure sounds like signs of SK Night to me.

Let me explain. This hobby, which is often the career of many of our members, is in fact an infectious calamity that forever permeates the body and soul of all who pursue it. Radiation infection has long been known to cause damage to body cells, but what the researchers missed was that the effects remained long after the hobbyist became SK (silent key). Hence, the beginning of SK Night!

Yet today, the lingering effects of this irreversible damage can be witnessed on many bands during the fall and winter periods, most notably centered on October 31st. The howls and shrieks from receivers today are actually the noise generated by our predecessors tuning their rigs in preparation of SK Night. What we call "static" crashes are really spark gap Morse being generated by some ancient operator. And just listen closely to the trees around your shack. The wind carries the "overmodulation" of those SK hams choosing to work AM. The wind is in reality saying "CQOOOOOOOO, CQOOOOOOO."

October 31st was scheduled as the first SK Night long before my time, so I can't really say when the first one was held. There are, though, some clues to substantiate these phenomena. Some of them are:

Earth or ground, used on schematics. A direct path to the originating members of the hobby.

Ghosts, or image frequency — you guessed it! These came direct from the old-timers.

Lost parts. Just because you can't find them doesn't mean that they're lost — they're just "repositioned" or borrowed. I suspect that they were much needed for repairs to ancient equipment, and because you have access to much more, they were "borrowed" by the SK crowd.

Key clicks — Not really a design problem, but just an SK ham trying his "fist" when you are, but slightly out of "sync" with you.

Dead band — Frequencies allocated to SK operators for practice sessions and meetings.

SHF and VLF — Super High Frequency is where I assume we would all like to reside at some time in the future, although we stand a very good chance of being assigned to the Very Low Frequency portion for at least a portion of eternity.

Lid — Not an improper operator as used today, but a word derived from long ago, describing the entry portal of an SK amateur's QTH.

Worm drive — An SK home-brew amateur using whatever is at hand to complete the project.

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CALENDAR EVENTS

Listings are free of charge as space permits. Please send us your Calendar Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the January issue, we should receive it by October 31. Provide a clear, concise summary of the essential details about your Calendar Event.

OCT 6

HOLTON, KS The Atchison County (Kansas) ARC will host their 1st Annual Northeast Kansas Ham Radio Swapmeet at Jackson County Fairgrounds, intersection of US-75 and K-16 in Holton KS. This is 1/2 hour north of Topeka. Talk-in on 146.775 (-600), and 146.52 simplex. Gates open at 6 a.m. Admission is $1. Tailgating $1 with one admission; under cover $3 with one admission. Some electric outlets are available. Bring your own tables, etc. For info and advance registration, call *Joel K1CQ* at *(785) 945-3763, E-mail [k1cq@arrl.net]; Darrel KCØEYU, (785) 442-3572;* or *Jim KØYLW, (785) 364-3989.* You can E-mail Jim at *[kØylw@yahoo.com].*

POMPEY HILLS, NY The Radio Amateurs of Greater Syracuse will present its 46th Annual Hamfest at the Pompey Hills Fire Dept., October 6th, from 8 a.m.–2 p.m. Take I-81 Exit #15 onto Route 20 East. At 6 miles look for Henneberry Rd. on the left. This site is located 1400 feet above average terrain, so bring your mobile rig and work some DX. VE exams at noon. Indoor and outdoor flea markets. Indoor tables *must* be reserved, $11 each. Call to *reserve* indoor tables. Admission $5. 16-years and under free. Breakfast (starting at 7 a.m.) and lunch served. Talk-in on 147.90/.30 MHz. For hamfest info write to *RAGS, Box 88, Liverpool NY 13088;* Tel. *(315) 698-4558.* See the Web site for more details, *[www.pagesz.net/~rags];* or E-mail to *[ragsonline@hotmail.com].*

OCT 7

MEDINA, OH The Medina Two-Meter Group will host the 2001 Medina County Hamfest at the Medina County National Guard Armory, 920 W. Lafayette Rd., 1/2 mile west of the fairgrounds. Vendor set up at 6:30 a.m. Advance tickets $4 each. Tables $9 each, includes one admission ticket per table. Open to the public 8 a.m.–2 p.m. For info about VE exams, please call *Fred* at *(440) 236-3477.* Walk-ins always welcome. Testing starts at 9 a.m. For general table info contact *Mike N8TZY* at *(330) 273-1519.* Please send your remittance, with an SASE, to the *Medina Hamfest Committee, P.O. Box 452, Medina OH 44258.* Advance reservations must be received by September 29th to guarantee space. All tables will be held until 9 a.m. on the day of the hamfest. If you have any special needs or requests, please let M2M know and they will try their best to help.

WALLINGFORD, CT The 9th Annual Nutmeg Hamfest & Computer Show and ARRL Connecticut State Convention will be held October 7th, 9 a.m.–3 p.m. at the Mountainside Special Event Facility located off Exit 15, I-91 in Wallingford CT. Follow signs. Talk-in on 147.36. Inside selling spaces $30 (booth space with 8 ft. table and chair). Outside spaces $20 for a 30 ft. space. If you reserve and pay in full before September 1st, deduct $5. Major vendors will be attending. General admission is $7, children under 12 $3. Sellers, contact Mark Mokoski WA1ZEK at (860) 808-1275 regarding discounts available for payments received before September 1st. Make checks payable to *Nutmeg Hamfest,* and send to *Mark Mokoski WA1ZEK, 944 Killingworth Rd., Higganum CT 06441.* For info regarding VE exams, contact *Joel Curneal N1JEO, (203) 235-6932.* Be sure to take a look at the Web site at *[www.qsl.net/nutmeghamfest].* E-mail to *[nutmeghamfest@qsl.net].*

OCT 14

DIMONDALE, MI The Lansing Civil Defense Repeater Assn., and the Central Michigan ARC, will co-sponsor a Hamfair at The Summit, 9410 Davis Hwy., Dimondale MI, October 14th, 8 a.m.–2 p.m. Take I-96 to Lansing, Exit 98B — Lansing Rd. North. Admission $5 in advance, $6 at the door, 12-years-old and under admitted free. Tables are $10.50 in advance and $12.50 at the door. This is a large location with plenty of parking. Vendor setup at 6 a.m. Talk-in on 145.390(-) and 146.520 simplex. VE exams (ARRL VEC) 9:30 a.m. registration. Walk-ins welcome, but pre-registration is strongly recommended. First come, first served. Info is available at *(517) 589-5263;* or E-mail *[n8vys@voyager.net].* ARRL Forum at 9:30 a.m., hosted by Great Lakes Division Director, George Race WB8BGY and Michigan Section Manager, Richard Mondro W8FQT. A Weather Forum with Kaz Fukita will be held at 11 a.m. Every SKYWARN spotter knows what the "F Scale" represents. Meet the son of the man who originated the "F Scale," and hear about his life and work in this fascinating field. There will be a Fresh Water DXpedition Forum at 12:30 p.m. Come and join Chuck LeMarbre W8VOM, and the gang, as they share the tales of activating United States islands. For reservations please contact *J. Ervin Bates W8ERV, P.O. Box 27321, Lansing MI 48909-7321;* tel. *(517) 676-2710;* E-mail *[w8erv@arrl.net].*

OCT 20

GOLDEN, CO The Rocky Mountain Radio League, Inc. will host their "2001 RMRL Hamfest" 8 a.m.–2 p.m. at Jefferson County Fairgrounds, 15200 W. 6th Ave., Golden CO. Take the Indiana exit from 6th Ave. Talk-in on 144.62/145.22 MHz. Admission is $4 per person. Tables $10 in advance or at the door. Features include an ARRL forum, VE exams, and refreshments. Contact *Ron Rose NØMQJ, (303) 985-8692;* E-mail *[nØmqj@arrl.net].*

OCT 21

KALAMAZOO, MI The 19th Annual Kalamazoo Hamfest will be co-sponsored by the Kalamazoo ARC and the Southwest MI Amateur Radio Team, October 21st at the Kalamazoo County Fairgrounds. Talk-in on 147.040 K8KZO rptr. Plenty of free parking. 54 campsites with electric and water. Vendor set up at 6 a.m.; doors open to the public at 8 a.m. Advance tickets $3, $4 at the door. Trunk sales $5. 8 ft. tables are $12 each. For tickets/tables, send SASE to *Charlie Burgstahler K8BLO, 6658 Carlisle Dr., Kalamazoo MI 49048.* For contact or info, E-mail *[charlieb@net-link.net];* or check the Web site at *[www.qsl.net/k8blo/hamfest.htm].*

QUEENS, NY The Hall of Science ARC Hamfest will be held at the New York Hall of Science parking lot, Flushing Meadow Corona Park, 47-01 111th St., Queens NY. Doors open for vendors to set up at 7:30 a.m. Buyers admitted at 9 a.m. Free parking. VE exams at 10 a.m. Admission by donation, buyers $5, sellers $10 per space. Talk-in on 444.200 rptr., PL 136.5, and 146.52 simplex. For further info, call at night only, *Stephen Greenbaum WB2KDG (718) 898-5599,* E-mail *[WB2KDG@Bigfoot.com].* For VE info only, contact *Lenny Menna W2LJM, (718) 323-3464,* E-mail *[LMenna6568@aol.com].*

SELLERSVILLE, PA The RH Hill ARC will hold their hamfest at Sellersville Fire House, Rt. 152, 5 miles south of Quakertown and 8 miles north of Montgomeryville, on October

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Whither e-QSLs?

Technology has engendered a new controversy that nibbles at one of the most sacred of the time-honored traditions of Amateur Radio: the QSL card. The Internet, once thought of as the bane of us all, has made it possible for QSL hunters to "go paperless" with the advent of the e-QSL.

The e-QSL, a sort of acronym for "electronic QSL," is nothing more than a computer-generated graphics file that looks just like the ones we get via snail-mail. It may be sent by one ham to another amateur as an E-mail attachment, or, in the case of a sophisticated server environment, be automatically sent without human intervention.

I am old enough to remember how much controversy swirled around the introduction of a new technology to Amateur Radio known as single-sideband telephony. It polarized the amateur community, and for many years was resisted by those seeking to maintain the status quo. But history has shown us that time wounds all heels, and that SSB is as commonplace as rain static on our amateur bands. Now we have e-QSLs to foment confrontation and lively discourse.

Just think of it! It is possible for QSLs to be sent and received without having to fill them out and lick the stamp. In fact, they can now be sent without any human intervention. Sounds great? Well, hang on there. There are those who would take the bloom from this rose, and for seemingly good reason.

The issue for us is the veracity, or "authenticity," of these QSLs. It has been argued by some that it would be very easy to forge an e-QSL, and that they are not verifiable but groups that judge the authenticity of QSLs submitted for awards.

But I will let you judge for yourself, and to help you, I will solicit the aid of Dave Morris N5UP, the founder of eQSL.cc. Dave runs a server on the Internet that automatically generates QSLs for subscribers who upload their logs to his Web page.

This is quite the dandy setup. I am not really qualified to articulate its inner workings, nor am I as well schooled in the controversies surrounding this new QSO verification medium as he is. Therefore, I have included here some information that Dave has suggested might be profitable for our readers to consider. Take it away, Dave!

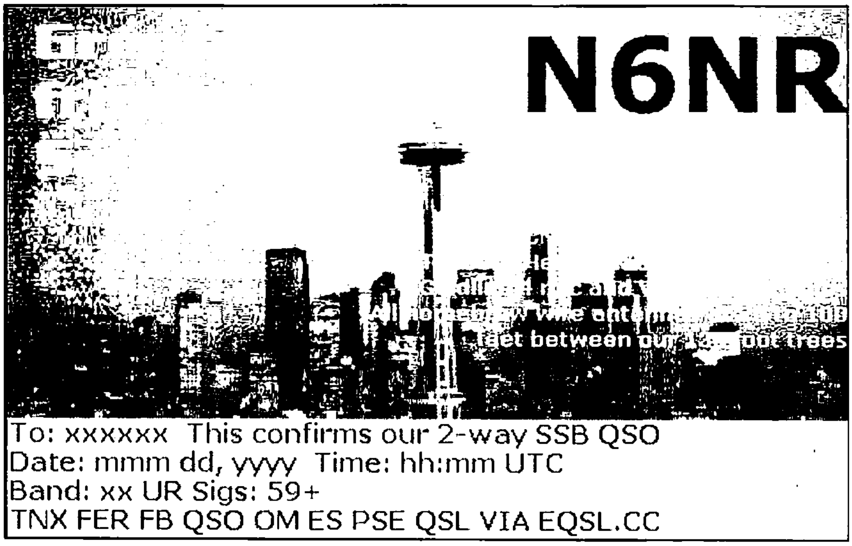

Fig. 1. Here is my e-QSL. Some of you may have already received this — if you're in my e-logbook, that is.

e-QSL — The Final Courtesy

The world's first and only e-QSL exchange center, www.eQSL.cc, started the year 2001 with a bang. Only a few weeks earlier, on the first of December, it had blown through the 1 million card mark, and now 2 million cards were in the central database. But instead of slowing down, the rate increased as thousands of e-QSL cards were uploaded every hour.

The eQSL.cc site was launched in April of 2000, and included about 1,500 hams who had been part of an earlier experiment in an electronic QSL card exchange. The "big" idea was that e-QSLs should not be sent around from person to person via e-mail, but should be available at any time through a Web-based exchange system and a central database.

Other concepts using e-mail or posting one stock QSL card on a Web page and calling it an e-QSL were not satisfactory, because security could not be guaranteed, e-mail addresses had to be looked up, and the sender had to laboriously design his QSL card using graphic design software.

So, we used our 25 years of software development and database design experience to develop a site where each user could guarantee his identity with a scanned image of his ham license, could lay out an e-QSL card design using simple point-and-click forms, and could upload logbooks either one-at-a-time or by uploading an entire ADIF-format log file at once. The concept is such a breakthrough, we have patents pending on its technology.

To retrieve one of these e-QSL cards, the recipient only need enter the callsign, date, and band of the QSO he wants to retrieve, and if the other ham has entered that QSO

into the system, up pops the complete e-QSL card, ready for printing on a local printer. Furthermore, if the recipient registers his callsign with us, he can get a listing of all incoming e-QSLs, and can just point and click to print each card received. Sending a reciprocal card back is a matter of clicking a button!

Apparently, most everyone else thinks this is the right way to do it, too. Another six weeks after hitting the 2-million-card mark, it appears the number of cards will double again to 4 million.

Many of the members of the eQSL.cc site are using stock images for their e-QSL card designs. But since it is possible to upload a graphic image to use on one's card, there are many custom cards on-line as well. Users are signing up from over 180 countries all over the world. In many places, a stack of 500 traditional QSL cards might well cost the average ham operator an entire year's salary. On eQSL.cc, 500 beautiful full-color cards can be sent for free!

In an era when "dot-coms" are failing left and right, it is noteworthy that the eQSL.cc site, which is supported almost entirely through voluntary donations, has been operating in the black since Day One. Since the site runs virtually without any human intervention, the only ongoing expenses are for development of new features, and for continually increasing disk space, processor power, and bandwidth. A small amount goes to answering the questions and suggestions that come into the web master's office by E-mail. In most cases, replies are returned within the same day.

Not everyone agrees that e-QSLing is the way to go. Some people like to get their hands on that stiff cardboard with the exotic stamps that spent months in transit from the jungles of some island that is only above water for 3 weeks out of the year. Others are bothered that some amateur organizations still have "no electronic transmission" clauses in the rulebooks for their awards. Others still are spooked by the privacy issues that this interconnected new world brings up.

But it's very difficult to argue — as the saying goes — with success. And 4 million cards is success by anyone's measure. At the present growth rate (with the number of e-QSLs doubling every month), eQSL.cc could be home to virtually all of the world's amateur radio operators within a couple of years. Contest "big guns" will be able to "QSL 100%" within a matter of minutes, saving hundreds of hours of time and thousands of dollars in the process. DXpeditions will be able to "QSL 100%" on the spot, whether it be from that desert island with a dial-up Internet connection, or when the crew gets back to "civilization." It's just a quick log file upload, and they are done!

And e-QSLs, unlike their traditional cardboard counterparts, can be verified through automated computer interfaces by amateur organizations wanting to validate award and contest submissions. The presence of a scanned license image on file for each user goes way beyond the simplistic checking that is possible using the older traditional QSL cards.

And now eQSL.cc is also a favorite site for SWLs, because users can identify themselves as either licensed amateur operator or SWL. The e-QSL cards between SWLs and hams are automatically configured to contain proper SWL phrasing, making their lives easier and saving them tons of money.

Complex systems shouldn't be designed in a vacuum, so we have assembled a capable group of hams and SWLs into an

New eQSLs

Action	Call	Date/Time	Band	Mode	Country	AG	Signal Report & Comments	Actions	
Display	OH3SR	Nov 12, 1998 21:40	12m	CW	FINLAND		599	Sent	Archive
Display	PA2PKZ	Jul 10, 1999 22:36	15m	SSB	NETHERLANDS		59	Sent	Archive
Display	VK4EMM	Mar 30, 1997 00:18	15m	SSB	AUSTRALIA		59	Sent	Archive
Display	VK4EMM	Dec 13, 1997 19:36	10m	CW	AUSTRALIA		599	Sent	Archive
Display	W1MCE	Sep 7, 1999 00:43	10m	SSB	USA		59	Sent	Archive
Display	WE9V	Nov 18, 1995 22:10	15m	SSB	USA		59	Sent	Archive
Display	WE9V	Mar 30, 1997 22:18	20m	SSB	USA		59	Sent	Archive
Display	WE9V	Aug 22, 1999 03:29	40m	SSB	USA		59	Sent	Archive
Display	YL2KA	May 24, 1997 02:30	20m	CW	LATVIA		599	Sent	Archive

Move checked eQSLs to ARCHIVE

Fig. 2. Here is a screen shot of the portion of the eQSL.cc Web page that lets me know what QSLs I have received this week.

Advisory Board. Among these advisors are users with satellite and DX experience, contesting backgrounds, and international origins, as well as technology gurus and people with long-term operating histories. This group discusses current issues and future development plans for the site on a daily basis. Just another feature of the interconnected world we have entered as the 21st century dawns.

There were naysayers when SSB first began to push CW aside. There were those who thought packet radio was just a short-lived fad. Others thought we shouldn't be wasting money on amateur satellites. And some people think e-QSLs are "not natural." But for tens of thousands of hams and SWLs who upload their entire logbooks nightly in an effort to live up to the "100% QSL" promise of amateur radio, the final courtesy of a QSO is an e-QSL.

What about an e-QSL that is transmitted to (an) organization electronically?

This is an entirely different issue. In order for an award-granting organization to accept an e-QSL electronically, it must construct a computer system that is capable of receiving the e-QSLs electronically, collecting them, and associating them with a particular applicant. There is considerable cost associated with this, both in terms of technology infrastructure and in resources required for administration.

If an organization wishes to accept these e-mail submissions and manually review them for now, we have a proposed mechanism for doing this using 100% secure, encrypted, and digitally signed e-mail in our Secure Log Mailer program.

But this is a source of confusion. If an organization says it will not accept electronic QSLs, it might mean: "We will not accept an e-mail containing a QSO log, because it cannot be verified," OR "We will not accept any document that has been electronically transmitted at any stage."

In this essay, we will not discuss electronic submissions, but will instead discuss why organizations should accept a printed card that has been generated from our on-line database.

Let's look at the differences between "traditional QSL cards" and "e-QSL cards."

A traditional QSL card has been printed by a commercial printer. It was filled out by hand, and may even bear a canceled stamp applied by the sender, which might attest to the fact that it was mailed through the postal service.

On the other hand, an e-QSL card was generated automatically by a computer system, based on input from the originator. The type and thickness of paper stock used to print the e-QSL is up to the recipient, not the originator. There will be no stamp and no cancellation marks from a postal service, because the e-QSL was printed by the recipient on his own computer printer.

Ham organizations may dislike the concept of e-QSLs because:

- Since the card is printed on the recipient's printer, it would appear that anyone could "make up" a card and claim credit for a QSO that did not in fact take place. We call this the "Printing Technology Problem."
- Since the card has no handwriting on it, the originator cannot verify that the card was filled in with his/her own handwriting. We call this the "Handwriting Problem."
- Since the card does not have a canceled stamp on it, there is no proof the card originated in the foreign country being claimed. We call this the "Postal Service Problem."

Let's dissect the problems one by one:

- In this day and age, anyone with a color ink jet or laser printer can forge a QSL card and make it look like a "traditional" QSL

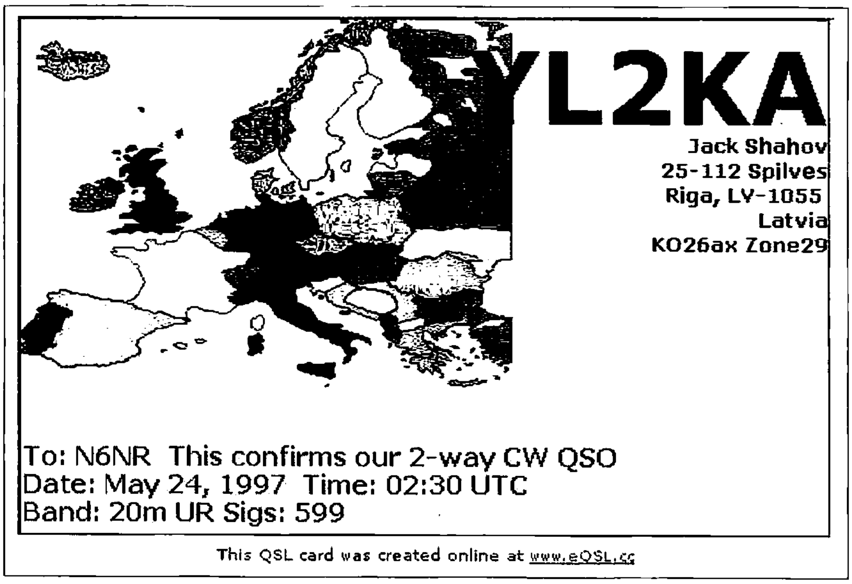

Fig. 3. By clicking on the "Display" button next to YL2KA, I am able to retrieve the image of his QSL card. If I so desire, I can print it on my color printer and hang it on the wall. Cool, huh?

card by simply using a heavy card stock. The forged card could then be submitted along with other authentic cards, fooling the organization. Thus, one cannot rely on thickness of card stock and colors to prove a card's authenticity. It doesn't matter whether this is a "traditional" card or an e-QSL! Printing technology is sophisticated enough that even the government has gone to extraordinary lengths to change our paper currency. If someone wants to make DXCC that badly, they will be able to make a card to fool anyone!

• Many people do not hand-write their "traditional" cards now, especially when sending out hundreds of cards. They use labels or type or print the information into the correct spots on a "traditional" card. Thus, one cannot say that only handwritten cards are authentic.

• Some hams like to mail QSL cards in an envelope to avoid having the postal service "mess up" the nice image or create folds, nicks, and bruises on the card. U.S. hams often mail "green stamps" along with their traditional cards to make it easier for DX hams to respond. Thus, a good percentage of traditional cards do not have a canceled stamp on the card itself. In addition, the concept of a QSL Manager and QSL Bureaus make the stamped, postmarked QSL card even more of a rarity. Thus, one cannot say that only stamped, canceled cards are authentic.

How might someone create a fictitious QSL card?

Note that, again, we do not believe award-granting organizations will be willing to accept e-QSLs electronically in the foreseeable future, because of the expense involved in doing so. So, we are still talking about creating a fake printed card.

A person wanting to create a "traditional" QSL card for a QSO that did not actually take place could use PhotoShop, CorelDraw, Adobe Illustrator, or any one of a number of different software packages to create a nice-looking QSL card in the correct size, and print it on heavy card stock in a color ink jet or laser printer.

How would the organization know the card was fake?

Right now, organizations cannot tell for sure if a "traditional" card is a fake, unless the person checking the cards has some suspicion that the card looks bogus. He or she would then contact both hams listed on the card and verify that the QSO actually took place. This could take weeks or months, because typically this verification must be done by writing a letter. Phone numbers are not always available and long distance calls cost too much.

How does eQSL.cc simplify this verification process?

We have a computer-to-computer QSO verification program that organizations can build into their automated QSL-checking software to verify any e-QSL against our database in an automated fashion. Instructions are in the VerifyQSO.txt file.

Alternatively, the person checking the cards would simply enter the callsigns, the date, and the band from the e-QSL retrieval screen, and the eQSL.cc system will verify that the originator did in fact place that log entry into the eQSL.cc database.

Could an unscrupulous person register as the "other" ham and create bogus log entries?

Yes, he or she could register and post fake log entries. This is why we created the Authenticity Guaranteed program. Under this program, a person can upload a scanned image of his/her amateur radio license. Another person wanting to check to see if the "other" ham might be bogus can click on the "Authenticity Guaranteed" logo and see the scanned license image.

Can the scanned license image be faked?

Go ahead and try! Most government authorities have selected a paper stock that would be very difficult to duplicate by amateurs. If a person is that hungry for a bogus DXCC certificate, he or she would surely be able to fake out even the most persistent attempts at validation, regardless of whether the card was submitted as a "traditional" or e-QSL card.

Can someone obtain an e-QSL card and modify the graphic to show a bogus QSO?

Let's say that someone wanted to obtain a DXCC certificate from ARRL by fraudulent means. This is the process he would have to follow to obtain an e-QSL and to corrupt it:

1. Obtain the date, callsign, and band of a legitimate QSO (from where?).
2. Retrieve the card that was supposed to go to the "other" ham.
3. Save the card on disk
4. Modify the graphic using photo manipulation software, overcoming the tamperproof coding in the graphic and without distorting the graphic when the bogus callsign is inserted (not as easy as you may think!)
5. Print the card and submit it
6. Hope that ARRL does not use the VerifyQSO software to verify the QSO against our log database

Don't be fooled by people wildly dismissing e-QSLs as being too easy to falsify. Anybody with a color ink jet printer can create any QSL card he wants to nowadays. The difference is that the eQSL.cc system is more secure and less easy to "fake," because every card can be verified all the way back to its source! — *Dave Morris N5UP*

Thanks, Dave, for submitting this for our consideration. It is clear that e-QSLs will continue to increase in popularity, and I hope they do. I also hope that organizations like the ARRL will see the benefit of online verification of QSOs, especially in the case of large DXpeditions, as well as other on-air awards. But it is also clear that the old-fashioned "snail-mail" variety will be with us for generations to come.

So, how do you feel about this new technology? Do you agree with Dave or not? Good or bad, I would love to hear back from some of you on this issue. I would like to include some of your opinions in the next installment of The DX Forum.

So until then, 73, and good DX!!

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Troubleshooting

A lot of us like to build our own gear. It's great fun! But what happens when you can't get the stuff to work like it should? All of a sudden it's no longer fun. And sometimes, you can feel totally frustrated. This month, I'll show you some troubleshooting tips that I've discovered over the years. And, we will look into some very common problems that face the homebrewer.

The more power out mystery: If you have ever built a QRP transmitter. I know you have come across this one.

The design says you should see about two watts at 7.040 MHz. But, when you measure the power output with your wattmeter, lo and behold you're getting eight watts out. But. the current being pulled from the power supply is only 150 mA! How can this be?

Well, you're being lied to. Here's what is happening. The final PA stage is oscillating. Instead of being an amplifier, it's an oscillator, too. The stage may be singing on the broadcast band, the VHF or UHF bands or all three at the same time.

The wattmeter measures RF. It's not really sure where the RF is coming from, it only sees RF. The RF could be from anywhere from DC to light. Most of the wattmeters we use are not very frequency-selective. The Bird model 43 is more frequency selective, because of the frequency sensitive slugs used, but it can be fooled, too.

The clue is the collector current. Since power is the result of current times voltage, it's not hard to see that with 150 mA and 13.5 volts we should see an INPUT power of about two watts. You can't have eight watts on the meter with an input of only two watts! Nope, sorry, can't be.

On the other hand, sometimes everything seems to be OK with a dummy load connected to the transmitter. When an antenna is connected, you see more power than you should have. The problem is the same, the PA transistor is singing. I've had the PA transistor go up in smoke when connected to an antenna, but work just fine into a dummy load.

The fix

There are several places you need to look, the first being the stages that drive the PA. Here is a case in which you really do need to use a scope. The scope will show you the purity of the signal being produced by the oscillator and or mixers. A spectrum analyzer would be ideal, but most of us just don't have access to one. If nothing else, drag out an old AM transistor radio. Use this guy to listen to low frequency oscillations in the broadcast band and below.

I take this a few steps further. If I have a problem with a transmitter, I will turn an FM radio on and a scanner running in the background. If you key the transmitter and you stop the scanner, you've got trouble! The transmitter is producing a signal the scanner can hear. Talk about a dirty signal!

Most simple QRP transmitters should be traced from the oscillator toward the PA. Look for a nice clean sine wave. If you come across a stage where the wave shows distortion, then you need to clean things up before moving toward the PA.

Usually, in a homebrew transmitter, lead length causes most of the trouble. All leads should be as short as possible. Make all ground connections as large as possible. In other words, if you're laying out a PC board for the project, use all the copper you can to make a low impedance connection to ground. Don't just run a trace from the ground to the transistor, use a lot of copper instead.

Keep the collectors decoupled from the supply lines. Usually a small choke will do the job. I've put in 22 µH chokes in most of my designs. You can set down and do the math to calculate the exact value needed if you so desire.

Also bypass capacitors on the RF ground side of the chokes will be helpful. I normally use some 0.01 caps and 0.001 caps to keep UHF critters off of the supply line.

Be mindful of the tuned circuits between stages. It's quite easy to get the stage to double a frequency instead of just amplifying the signal. If the stage has a trimmer capacitor to get the circuit resonate, adjust the trimmer for the cleanest signal and not for the strongest signal. It's amazing how a slight tweak of a trimmer in the oscillator stage can clean up the transmitter.

Check how the stage is being keyed. I've found emitter keying of a driver stage can cause problems if the key line is too long. The best fix is to use a small relay driver between the keyer and the transmitter.

If you find the stages before the PA to be clean, then the PA transistor is doing the singing. The fixes are just about the same. Make sure the emitter lead of the PA transistor is as short as possible. Make sure the emitter is tied to a large ground pad and not just a trace leading off of the emitter to ground. The trace, if long enough, will become an inductor and cause all sorts of critters to grow.

Depending on the design of the output filter, you might need to rework things a bit. Most of the simple one coil and two capacitors designs used in simple one-watt rigs are just the bare minimum. Improving the filter can sometimes fix the problem.

Here's a hint. If you are having problems keeping the PA stage happy, run the transmitter into a dummy load for a few minutes. Now, quickly feel the output filter's components. Find any really warm or out-and-out hot? Hmmm. They're not supposed to do that.

And don't forget to add bypass and decoupling capacitors to the collector of the PA transistor. The collector needs to have an RF choke in series with the supply line,

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Cutting-edge hamware from DXLab

Ham radio is a high-tech hobby these days, but I have to say the software you find displayed in this month's column is better described as the scientific approach to hamming. I was sitting on the sidelines for some time watching the DXLab discussion group and was, frankly, intimidated by some of the ideas presented.

My curiosity got the best of me and I simply had to see what this was all about. I had been a bit busy to get into the fray earlier, so this was discovery time for me. I could see ahead of time that this was going to be a project for a special display and wondered if it could work on my teeny little monitor. It did and it can work for you as well. Bigger is better, and I have noticed the price of larger monitors is receding, so I may meet you at the computer mall before we know it.

Anyway, after I got all this software up and running and arranged so it was useful, it was a real blast to just "click and pick" my way around without making contacts. Even after completing a half dozen QSOs and getting them nestled in the log module, it was still fun to go back and run the various modules through their paces just to watch them work.

Anyway, here is a whole new group of free stuff for your digital ham station. If you are using the WinWarbler PSK31 software you are probably aware of these new offerings from Dave AA6YQ. However, it has been a while since we discussed the WinWarbler program, so I will recap the story and give a rundown on the related goodies.

In the beginning, things were simple. PSK31 was developed and it was possible to communicate successfully with some basic software over great distances with low power under some pretty adverse conditions. Sounded good, and along came the developers bent on introducing us to bells and whistles, as the saying goes.

After a year or so some very nice pieces of software had been written and there was a PSK31 engine developed by Moe Wheatley AE4JY, that started to intrigue some clever programmers. Dave came on the scene and wrote the first version of WinWarbler and it was a bit different (revolutionary?) and showed great promise.

This new software took full advantage of the new PSK engine and produced three receive panes, all in parallel horizontal patterns. It was not the first multi-paned PSK program. WinPSK already contained a similar feature because it was one of AE4JY's products.

Dave felt he had a mission to accomplish and this first version he released, though it resembled the screenshot in today's column, underwent many changes. If you go to the URL listed in The Chart you will find a history of the fixes and improvements that make the current version a truly great piece of work.

As a standalone program it performs great and works well on my old slow 120 MHz CPU machine with the 32M RAM. But, as I started taking advantage of the new goodies available, I found it necessary to install this software in the slightly faster computer, property of the XYL. It has 500 MHz CPU and 64M RAM and seems adequate for the operation.

I mention some of this because it was necessary to install all the components in that machine and you will find the installation procedures are outlined on the download page of the Web site, so all that is necessary to accomplish a trouble-free installation is laid out for you there. Just follow the directions and life is good.

To be clear on the matter of speed and memory needs, I found the individual programs were able to run fine on the slower machine but the interaction did not take place. For example, the frequency readout was not shared by the co-existing programs. When they have enough resources, everything works as advertised.

What it does and it is easy

I installed just three of the six programs to begin with. WinWarbler all by itself is a lot of fun. There is one item I should stress. The WinWarbler, somewhere, about a year ago, midway in its evolutionary process, began to require an 800 x 600 display on the monitor. Many computers display most software quite well set at 640 x 480. You can change this by going to the Windows Control Panel and selecting Display, then click on the Settings tab.

The possibilities in my slower machine with Windows95 seem to stop with a choice of 640 x 480 or 800 x 600. With that machine the 800 x 600 works best for most of the ham software these days as long as only one panel is displayed at a time.

Windows98 is on the faster machine here in the shack and the drivers and monitor combination afford a wider latitude of settings. It normally runs in the 800 x 600 display and a lot of your monitors may already be doing the same.

I find with multiple programs being displayed it becomes inconvenient to stick to the 800 x 600 display because one program display will just about cover anything else and you find it necessary to do a lot of clicking on the task bar to see what is going on "underneath."

Therefore, if you want to enjoy the real benefits of the software, you will need to achieve displays such as you see in the screenshots today. You can do this if you can get the display into the "higher numbers' such as 1152 x 864.

Also, it is a great help if you have the biggest monitor you can fit through the door of your shack (an average-size monitor is

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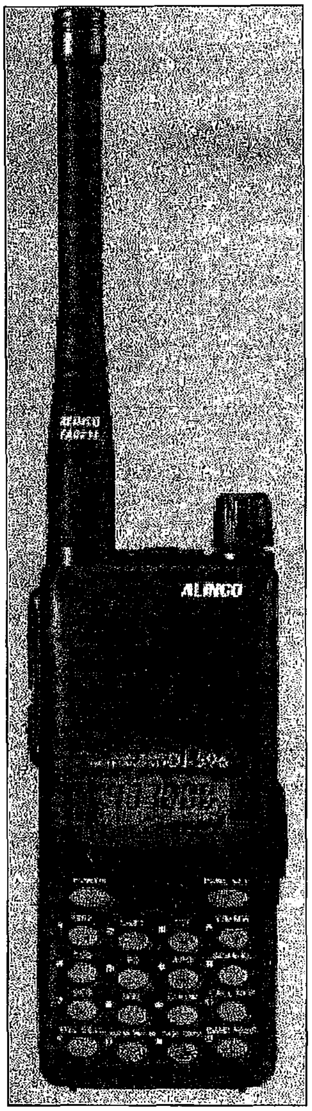
New Products



Alinco Introduces DJ-596 Dual-Band HT

Alinco has introduced the DJ-596 VHF/UHF HT, a compact unit that can transmit up to 5 watts output on the 2 meter and 70 cm bands in analog wide or narrow FM; with the optional EJ-43U digital board, digital voice communications are also possible. The announcement of the new unit was made by Craig Cota of ATOC Amateur Distributing, which distributes Alinco products to dealers in the USA and Canada.

The DJ-596 has 100 memory channels, full coverage of the 2-meter and 70 cm USA Amateur bands, extended receive capabilities, CTCSS and DCS encode+decode, three scan modes, the ability to work and save in memory any number of odd split transmit/receive offsets and it can transmit and receive in both the wide and narrow FM modes. A nickel metal hydride battery is standard and the unit will accept and operate on a wide range of input voltages, from 6 to 16 VDC. Illuminated keys and display add to operator convenience in low-light conditions. The large display can also show alphanumeric designations for each memory channel. A theft alarm and experimental "mosquito repelling sound" are among the unique features, along with more traditional items such as nine autodial memories. A new feature is External Terminal Control, which can output 5 VDC at 5 mA from the mic jack, which can be used by experimenters to control external devices.

Digital Voice Option

Alinco is also introducing an optional Digital Voice Communication Board, EJ-43U, that can be used in conjunction with similarly equipped DJ-596 units to achieve digital voice communications. Simultaneously, Alinco is also introducing the EJ-40U Digital Voice Communications Board for use in its new line of mobile radios, the DR-135/235/435 series.

The digital boards allow the operator to easily select between analog FM communications and digital voice operations. The Alinco digital boards use the open ITU-TV.32 protocol. This processed signal modulates the VCO in GMSK direct frequency modulation using a GMSK modem. It is then transmitted as a 20F3E conventional FM signal.

Alinco terms these boards as a "first step" in the use of digital communications by an Amateur Radio manufacturer. It acknowledges that the digital audio has a "processed" sound due to several limitations, specifically restrictions on bandwidth, the ability of the transceiver to switch between analog and digital operations, and cost constraints that keep the unit affordable for the widest possible audience. It added that commercial digital radios have price tags in the thousands of dollars, while the DJ-596 is very competitively priced in the dual-band Amateur Radio marketplace, with an MSRP of $301.95. ("Street" prices set by dealers are often lower than the MSRP.)

Alinco emphasizes that the digital protocol used is an open format and is no different in principle from the use of other widely used digital protocols such as AX.25, Pactor, GTOR, PSK 31, and the like. Signals transmitted from the units are not encrypted and can be monitored by any similarly equiped unit or any station able to receive and decode the ITU-TV.32 protocol. Alinco has posted a detailed FAQ about its digital operations at its Web site, [www. alinco.com].

Operational Features

The DJ-596 is designed in accord with Alinco's "Simple, Clean, Dependable" philosophy. As such, controls are kept to a minimum with an emphasis on easy operations. Frequency can be input directly from the keypad, then saved into memory. The volume and squelch levels are set by pressing the appropriate key and then turning the dial to the desired level, which is preserved electronically, reducing the chance that settings could unintentionally be changed. The 100 memory channels are easily programmed and can be allocated in any combination of VHF or UHF frequencies. The transceiver can also operate in a split-band mode. Additional user-activated options include time-out timer, busy channel transmit lockout, battery save, scan modes, and more. The DJ-596 can also be used for 1200 bps packet operations with an external TNC.

Technical

The DJ-596 can output a full 5 watt signal yet weighs just 11 oz. It has a standard BNC antenna connector and has an amazing ability to accept a wide range of input voltages, from 6 to 16 VDC. While connected to an external DC power source the NiMH battery is recharged but not overcharged.

For further information, contact ATOC Technologies, Inc., 23 S. High St., Covington OH 45318-1309; or phone Alinco at (937) 473-2840.

Mini Paddle System

Morse Express is now carrying a new miniature paddle system from Palm Radio in Germany. Designers Hannes DL9SCO and Dieter DJ6TE have produced a small (1x1x3-in.) and light paddle system that covers all the bases for portable, mobile, and shack operation.

The system consists of the retractable paddle mechanism and housing (available in three versions), a snap-in mount which can be attached to a radio or other surface (with screws, magnets, or adhesives), molded connecting cord, and super strong magnets.

Priced from $69.95 to $74.95 (plus s/h), the Palm minis are available from Morse Express via phone at (800) 238-8205 or E-mail at [n1fn@MorseX.com]. The Web site is [www. MorseX.com].

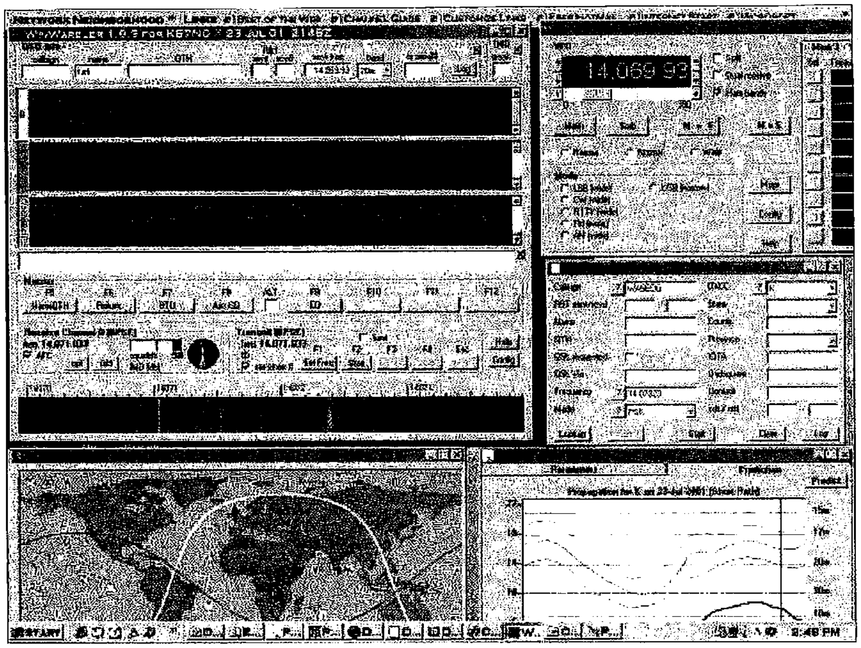


Fig. 1. Suite screenshot — These are the five interacting panels of DXLab's suite of freeware. The upper left is the WinWarbler PSK31 program. This receives and displays text for three simultaneous signals. When you click or double-click in a receive pane your transmission is then on the frequency of the pane's color-coded trace in the waterfall. Macros are a snap to program. This is a fresh installation, so much of the configuration is minimal, but adequate to support testing and communications. WinWarbler was featured in this column in November, 2000. That was version 1.6.5. This is version 1.9.3. When you double click a callsign, it is not only placed in the callsign box you see in the upper left, it also is grabbed by the two programs partially displayed at the bottom. From there beam heading and propagation is determined by DXView and PropView. These two panels can be moved into full view on this monitor by grabbing their top bar and sliding them upward. The light colored line whose upper midpoint is over Europe is the terminator line depicting sunrise and sunset. The other line passes through a dot at my QTH and a dot in 5-land because there was a stateside callsign entered at the time. This works just as well for any callsign in the world to provide instant beam headings and give info to a computerized rotator. More about these two lower panels elsewhere. The panel in the upper right is the CI-V rig control. The frequency displayed matches the rig frequency and sets the scale at the left of the waterfall. From there the WinWarbler program calculates the exact frequency of the station you are copying. The small entry window for DXKeeper is in the right middle. You must make a manual entry of the callsign and then you can click Lookup and the "?" marked boxes will be recorded, plus a search for previous contacts is performed. From there you enter info you require. Pressing start records the beginning of the contact. Pressing Log records the info to the database and clears the boxes for the next contact. All the programs have on-line Help available by clicking the Help button.

The Digital Port

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good, two sizes up is better; if it requires a crow bar to get it through the door-opening it is just right.). I have not applied this update as yet, so I resort to the squinty-eye approach to viewing all those panels, but it works and it is fun.

Rig control

The second program I installed to work with the WinWarbler was the CI-V Commander. It can be downloaded from the same URL as the WinWarbler and comes with its full complement of installation instructions. This is one more portion of Dave's vision of the complete computer controlled ham station.

I had an earlier experience with the CI-V Commander and this is an update with more bells and whistles and very easy to configure. This is the only program in the group that is specifically written for the Icom line. I am in good shape for this because that is what is in the shack. If you do not have Icom, there is still great value in the rest of the freeware offerings you will see here.

What was fun for me was the fact that I had these two programs working and I couldn't resist making a contact. During the QSO I stopped for a moment and explained to the ham on the other end that I must go take a look at the rig, that I could not see the front of it on the operating table next to the desk where the computer was mounted.

It wasn't necessary to see the rig because the frequency was reading on both programs on the monitor in front of me and it was only necessary to go over and verify the soundcard drive was correct. I was sure it would be okay but I could not recall checking it that day. The ham at the other end was, needless to say, as impressed as I was.

Though I didn't describe what I was doing at the time to establish bragging rights, it is fun to realize you are working with a novelty others only dream of. I guess that is why I am writing this. You too can have these wondrous devices in your shack.

You would like a log to go with this?

Although WinWarbler has its own basic logging program that exports in ADIF format, Dave has written a highly sophisticated, separate, self-contained, full-function logging program to be run in conjunction with the two programs I have mentioned thus far.

It is DXKeeper, and will track your awards, print QSL cards or labels and just about everything you ever wanted a log to do for you. And this will run in the background with WinWarbler and CI-V Commander and share automated entries.

This piece of software is also available with installation instructions at the same URL. You can get a feel for the entry process from the small panel in the main screenshot. The small entry screen takes care of the usual information you are accustomed to along with special extras. The main page for the DXKeeper log system requires a full screen to present. It is self-explanatory when you see it and very easy to navigate.

You can import current data from your current log program(s) you may be using in several formats including ADIF. Then you simply take it from there. Track your progress for whatever awards that are your goals or just simply keep track of QSOs with their attendant QSL exchanges until you become curious how many countries you have worked on which bands and in which modes. Makes it easy.

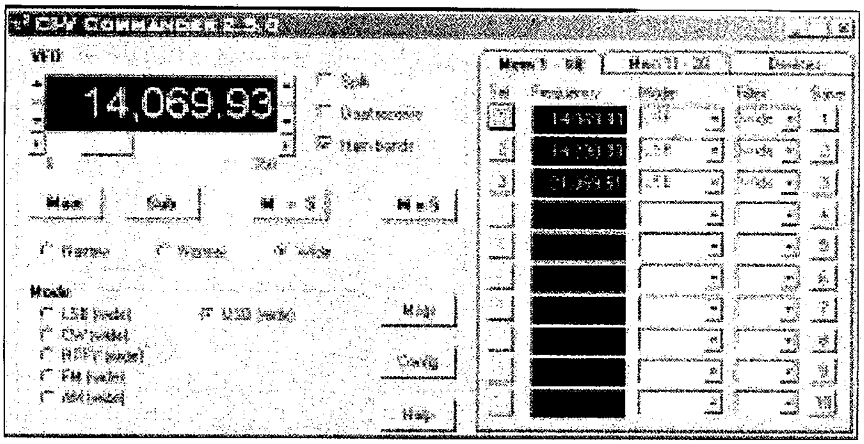

Fig. 2. CI-V Commander screenshot — This is the best program I have used for rig control with my Icom rigs. It is intuitive. You can click the controls around the frequency display and it will take only a minute or so to master changing frequencies. Also changes modes and filters easily. And it takes but a few seconds to get the hang of programming frequencies in the boxes at the right. Again, I only did a few to see how it works and a frequency on another band is no problem at all. Just a click away.

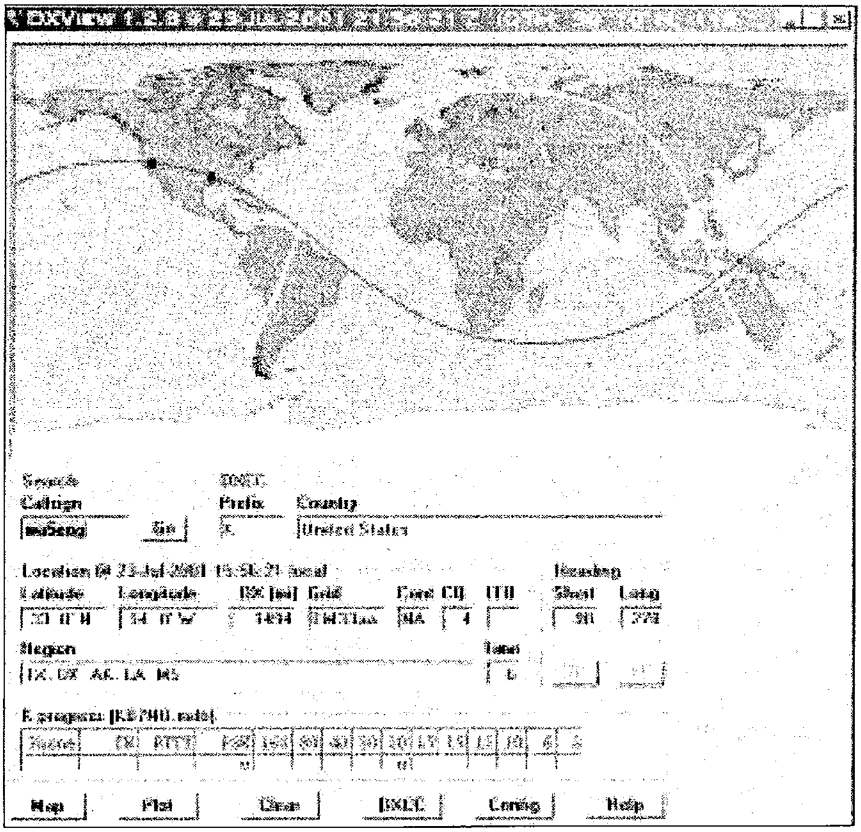

Fig. 3. DXView screenshot — This is one of the fascinating panels that is really fun to play with. As mentioned elsewhere, the program grabs the callsign from the WinWarbler and starts calculating and plotting immediately. You can see the terminator line depicting sunrise-sunset which updates with a little blink frequently. The other line plots beam heading for both short path and long path. The main part of configuration on your part is entering your latitude and longitude. You will need to slow down and follow instructions to get that correct. A real eye-catching graphic show presents itself when you click the Map button. A well defined map of the area where the other station is located comes up and you know exactly what the other ham is telling you about his neighboring terrain. I found myself entering fake callsigns with worldwide prefixes just to watch it work.

On to propagation

After installing PropView, it looked as though this might push me into the learning curve to figure what all the little boxes require for input. But no, this was all taken care of. A box popped up and said I needed DXView running and I would not have to be nearly so clever, or words to that effect.

I had forgotten to install the latter software, but as soon as I did and brought up the DXView program, things fell into place. I clicked a few buttons, made an entry and, suddenly, PropView loaded itself and, showed me the two programs spoke fluent ham-chatter to each other. All the good things had happened before I had a chance to hunt down the instructions and read about it.

What I am saying is the software is

beyond intuitive. It takes you by the hand and leads you into dimensions of hamdom you may never have seen before. When I got all the five pieces of software running and displayed I found there was much more interaction than simply keeping track of frequency and mode.

I found when I double clicked on a callsign in a receive pane in WinWarbler, the callsign appeared in DXView, which immediately performed the calculations to tell me where this station was located, spot it on the included world map, show how far away it was as well as which direction to point the beam. And if I had a computer controlled rotator it would give it a little nudge to aim the antenna as well.

All this happens plus the PropView only requires a click on the Predict button and it determines the probability per propagation

Source for:	Web address (URL):
Mix W Soundcard program for PSK31, RTTY, new modes, MTTY, FSK31, more	http://tav.kiev.ua/~nick/mixw2/ www.nvbb.net/~jaffejim/mixwpage.htm
FREE MMHam site — MMTTY — MMSSTV	www.geocities.com/mmhamsoft/
FREE VK7AAB — SSTV-PAL — PSK-PAL	http://users.origin.net.au/~crac/
Much ham info w/SSTV downloads	www.conknet.com/~kb1hj/index.htm
TrueTTY — Sound card RTTY w/ PSK31	www.dxsoft.com/mitrtty.htm
Pasokon SSTV programs & hardware	www.ultranet.com/~sslv/lite.html
PSK31 — Free — and much PSK info	http://aintel.bl.ehu.es/psk31.html
Interface for digital - rigs to computers	www.westmountainradio.com/RIGblaster.htm
Soundcard interface info — includes Alinco	www.packetradio.com/psk31.htm
Interface info for DIY digital hams	www.qsl.net/wm2u/interface.html
WinWarbler info and DXLab Suite	www.qsl.net/winwarbler/
MFSK-related tech info — how it works	www.qsl.net/zl1bpu/
Throb — New — lots of info	www.lsear.freeserve.co.uk/ www.btinternet.com/~g3vfp/
Download Logger, also Zakanaka	http://www.qsl.net/kc4elo/
PSKGNR — Front end for PSK31	www.al-williams.com/wd5gnr/pskgnr.htm
DigiPan — PSK31 — easy to use	http://members.home.com/hteller/digipan/
TAPR — Lots of info	www.tapr.org
TNC to radio wiring help	http://freeweb.pdq.net/medcalf/ztx/
ChromaPIX and ChromaSound DSP software	www.siliconpixels.com
Creative Services S/W Multimode w/PSK	http://www.cssincorp.com/products.htm
Timewave DSP & AEA (prev.) products	www.timewave.com
Auto tuner and other kits	www.ldgelectronics.com
XPWare — TNC software with sample DL	www.goodnet.com/~gjohnson/
RCKRtty Windows program with free DL	http://www.rckrtty.de/
HF serial modem plans & RTTY & Pactor	http://home.att.net/~k7szl/
SV2AGW free Win95 programs	www.raag.org/index1.htm
Source for BayPac BP-2M & APRS	www.tigertronics.com/
Int'l Visual Communications Assn. — nonprofit org. dedicated to SSTV	www.mindspring.com/~sstv/
Hellschreiber & MT63 & MFSK16 (Stream)	http://iz8biy.sysonline.it
HamScope — multimode w/ MFSK16	http://users.mesatop.com/~ghansen/
YPLog shareware log — rig control — free demo	www.nucleus.com/~field/
WinLink 2000 System info	www.winlink.org/k4cjx/
Airmail — free program to use WinLink 2000	www.arimail2000.com/

Table 1. The Infamous Chart ... updated monthly.

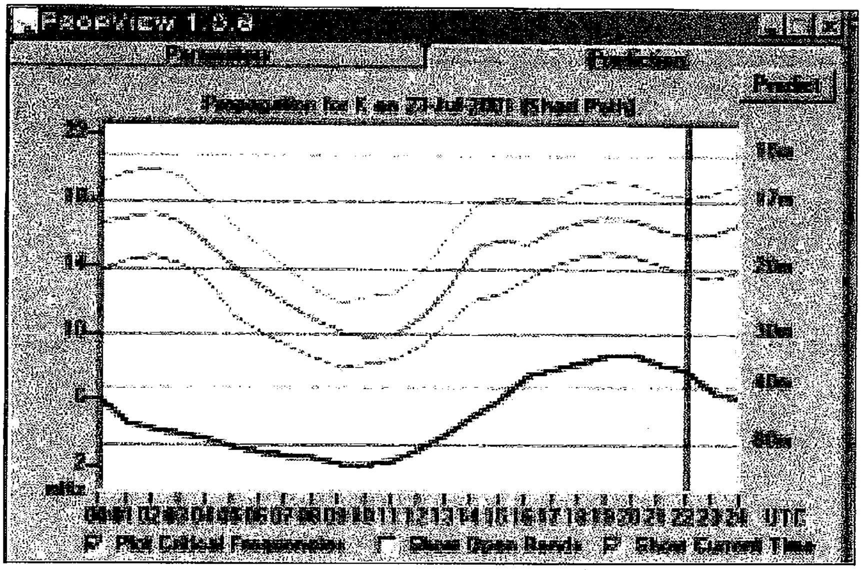

Fig. 4. PropView screenshot — This is another program that is fun to watch. Again, this is displaying propagation for a station in the 5 call area. As you read the very clear instructions to understand the meaning of the wavy lines it becomes obvious what frequency at what time will be the best to make contact. Users report great success in following the readings. The vertical bar toward the right of the graph represents the current time as depicted across the bottom. The horizontal bars represent frequency with MHz displayed at the left and bands on the right. It takes just a few moments to calculate for a new callsign or update the current information.

you have of working the particular station on which bands. Getting back to the DXView, there is another handsome feature where it is only necessary to ask (click) and it will display a map of the region where your potential contact is located.

If this isn't enough, I was a little concerned that this might not interest a lot of us who mainly make stateside contacts. The program furnishes all the same info and does the calculations for a station located anywhere on this continent, regardless of its proximity to your station. It makes it even more fun as you can bring up a map of that area of the U.S. and get a closer feel for the ham you are talking to. Another quick lesson in geography makes it almost like being there.

More in the future

According to a note on the DXLab Web site there is more ham software about to appear from this prolific author. He has posted for all the world to see that he intends to add a RTTY module and a CW module.

I hope this comes about. It is possible, given some time and a little inspiration, sometime soon there could be a super multimode entrant for the use of the ham community. From what I see with other rig control software it could be a little difficult to match the rig control up with other transceivers such as Kenwood and Yaesu. It seems to be easier to write the software for the various modes, but we can always hope somehow this can come about.

As I sit watching this late into the evening, I am impressed with the stability of the software. I think just once today, I managed to do something out of order and one of the modules shut down. It didn't crash, just simply had to reload the one program and it has run fine ever since. Plus, I checked into the Internet connection with the software and the rig running and that didn't bother it. Kept right on truckin'.

Why didn't I answer the E-mail?

There have been some real problems in E-mail land around here. This is July when I am writing this and I don't know when the previous long-standing ISP is going to stop accepting your E-mail messages to me. They left me a message over two weeks ago that they had sold to another outfit. Within hours, I lost the ability to sign-on and retrieve my E-mail.

I called, sent E-mails by the handfuls and got no response. Then I learned several things about which I have no control. One is that I could not even cause the credit card people to shut off the billings from the ISP; the ISP has to do it. The other is the new ISP owner seems to have no control over putting a stop to this problem.

So you folks who have sent E-mail to the old address after July 6th will never receive a reply because of this. I signed on with the largest company I could find hoping to avoid this problem in the future. Some of their software does not do what I would like but I will live with that as long as I don't experience the disappearing-in-the-night syndrome again. Of course, there are no guarantees. You pays your dues and you takes your chances. There is one good result; the spam is gone for the time being, at least.

A little note on the summer condx

As I mentioned, this is July and usually propagation dies this time of year. It is sporadic where we like to hang out but just the other evening, I came into the shack to shut down the computer and checked on 20 meters and recognized a Hellschreiber signal. MixW 2 was up and running, so naturally, I had to see if it would print on the monitor.

It was weak but it was F8RZ and I managed to copy the signal well enough to get the callsign and give it a try. Jean came back even though I too was producing a weak signal. I tweaked the beam heading and we had good enough copy to call it a success during which time he explained he was using a vertical and not a lot of power.

I felt good about the QSO mostly because the evening after this I felt fortunate to get readable signals in any mode from the east coast. So digital is making a lot of low power communications possible and the more this happens the more activity we will see even during the normally poor condition times.

That is about it for this month. Keep on having fun. If you have questions or comments about this column, E-mail me [KB7NO@worldnet.att.net]. I will gladly share what I know or find a resource for you. For now, 73, Jack KB7NO.

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You be safe out there!

Ham operators are among the most readily dependable people when disaster strikes. Hams come ready, willing, and able to help. We bring our own equipment and supplies and are notoriously innovative and enthusiastic. Many are not only communicators but trained in damage assessment, shelter management or other critical disaster service skills. Intentions are noble but it is results that count. How can we improve our performance to provide even better service to those who depend on us?

First and foremost is to remember that old maxim from the sixties, "If you're not part of the solution, you're part of the problem." Actually, for our purposes I'd like to turn that around and say, "If you're not part of the problem, you're a better part of the solution." When hams are called to provide assistance, one of the assumptions that everyone makes is that we will be part of those who render assistance rather than be among those who need assistance. Any volunteer who is rendered ineffective due to an injury becomes just one more victim who needs attention and it is an instant transformation from an asset to a liability. Sometimes it will happen no matter how careful we are, and is just part of living in an imperfect world. Most problems are preventable, so we should make every effort to plan well enough and think through the situations so that we can avoid as many problems as possible.

The first priority I feel each of us should have is to ensure that those who depend upon us every day are adequately cared for first. We can only concentrate on the tasks at hand if we are not unduly concerned about the family and their safety. This seems like such a basic thought that it may be embarrassing to some to even see it written down. While I wouldn't suggest that any ham would intentionally leave the wife and kids to their own devices in a disaster, it can happen. Take this example; the potential for severe weather has been identified. You head down to the local weather service office or your storm spotter location to assist. The situation deteriorates rapidly and you find yourself cut off from your family. You are unable to determine if your family is safe and it is impossible to get to them. Where is your mind apt to be? (I'd be remiss if I didn't interject here that this is another excellent reason for the wife to go from XYL to YL by getting her ham license. If nothing else, your chance of checking in with the home front increases significantly when the contact is via ham radio!)

Make sure that your family has an emergency plan for such common emergencies as weather (both summer and winter) events, flooding, etc., before you take off to assist. Do they have something comparable to your "grab and go" kit that contains radio, flashlight, drinking water, munchies, extra batteries, etc. Even if no one else is licensed, a scanner with the local repeaters programmed in may be appreciated. If duct tape is an essential part of your kit, doesn't your family emergency kit deserve its very own roll? Pack everything into a large plastic container such as a storage box or even a garbage can and make it accessible in the area where your family might take refuge. Does everyone have a clear understanding of what to do if you and the family do get separated? Although the primary plan is to stay at home as long as it's safe, what if your home is damaged? Where do you meet then? It's a good idea to have a standing plan that everyone knows.

A disaster does tend to bring out the best in neighbors, but if there is a neighbor who counts on you for a little extra help on a regular basis you really should plan ahead for what they'll need when something significant happens. Likewise, having a "mutual assistance" understanding with a neighbor or two can turn a potential nightmare into a more enjoyable and even a social event. Pooling resources and efforts always make for better results even under the most adverse of conditions.

Once you're sure that your family is taken care of, and you head out to offer your assistance, you will probably be better able to focus on your duties if you know the family is safe. Next, you need to make sure that you keep yourself as safe as possible. First, don't show up until you know that you are needed. Don't be shy about asking, but it takes a little time, even when a disaster recovery effort has been well planned, to determine what resources are needed and where they should be deployed. Not everyone is going to be needed in the first hours of the recovery efforts. In fact, it may be several hours until the majority of people will be able to be effectively used. Fires must often be dealt with, as well as downed power lines, natural gas leaks, etc., before relief efforts can begin.

If and when your services are needed, don't forget to dress appropriately. Although it may be second nature to dress for the weather, there are other factors during a disaster. If you will be walking through the disaster area to perform damage assessment, your shoes will be your most important piece of clothing. Sneakers may be the most comfortable, but if there's the chance of debris, something with a durable sole that can protect you from nails or other pointed objects will be helpful. Myself, I still use my old combat boots with the appropriate cushioned socks. If there is flooding, assume that the water has just flowed through all kinds of nasty conditions, and try to avoid it if possible.

Assume the worst in most situations. A downed power line should always be considered live. The power may actually have

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Wildlife tracking update — burrowing owls found, saw-whets sought

Since it was first used in World War I, radio direction finding (RDF) technology has progressed steadily. In this first year of the second century with RDF, we have high-rate VHF/UHF doppler sets that can share bearings via APRS, and a network of government HF-RDF base stations that can triangulate transmissions in seconds. But some RDF tasks are still done mostly the old-fashioned way, with simple receivers and beam antennas. One of these tasks is wildlife research.

You may have seen Web sites that show the movements of migratory animals tracked by Argos satellites. This technology has been a boon to biologists studying large birds, such as the sandhill crane and Harpy eagle. But it takes at least a half watt to get the signal to a satellite. At 20 to 30 grams, Argos transmitters are too big and heavy to be put on most small birds, mammals, and reptiles, so these species are tracked directly from the ground or aircraft.

Government regulations require researchers to use tag transmitters that are only 3% to 5% of a bird's weight (**Photo A**). Six to twelve months of tracking data is needed for migratory studies, so long-life lithium batteries are the favorites. Transmitters are pulsed for a millisecond at a time to conserve these batteries. Weak short-pulsed signals are not suited to spread spectrum or doppler technology, so sensitive narrowband receivers and high-gain beam antennas are still the tracking method of choice.

There's a need to search a lot of territory once the animals to be studied have dispersed. Small aircraft can cover lots of ground, but that's very expensive and usually it's not effective during a cross-country migration, due to weather interruptions. That's where amateur radio comes in. Hams are almost everywhere and most of us already have suitable equipment. We can monitor for days and weeks at a time, letting the animals come to us.

Burrowing owls in XE-land

Back in August 1998, I first told readers about the Burrowing Owl Project (**Photo B**). Researchers in Saskatchewan and Alberta are trying to understand why these ground-dwelling raptors are diminishing in northern prairies. Surveys show a contraction in range and a steady reduction in numbers of about 16% per year from about 3,000 pairs in the late 1970s to fewer than 1,000 pairs currently. A similar trend has been noted in the USA.

Low return rates after migration, especially for young birds, suggest either high mortality or dispersal outside the study areas. Four years ago, scientists fitted some juveniles

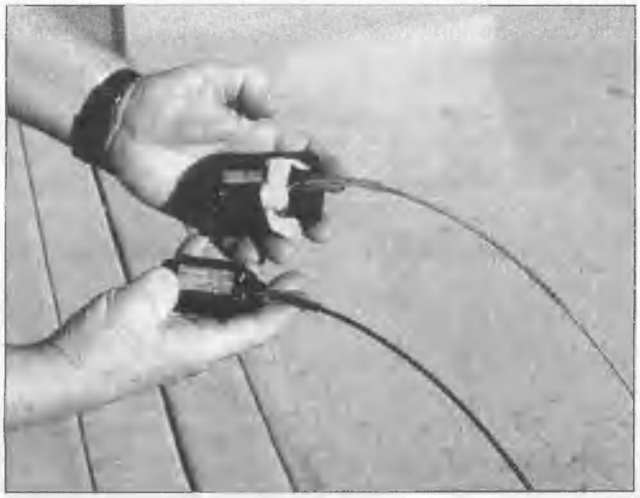

Photo A. *To get higher power and longer life, the battery size and weight of radio tags must increase. Transmitters like these are too heavy for burrowing owls, but are suitable for larger waterfowl, such as pelicans.*

Photo B. *The burrowing owl is the only ground-dwelling raptor species, taking over other animals' holes such as this to raise its young. Hams are helping researchers understand why their numbers are diminishing.*

Photo C. *Charming and mysterious, the northern saw-whet owl* (Aegolius acadicus) *is the smallest owl in eastern North America. Researchers are asking hams and VHF monitoring enthusiasts for help in tracking them. (Photo courtesy of Scott Weidensaul)*

with 6-gram VHF radio tags and attempted, unsuccessfully, to follow them south in the fall to find and study their wintering grounds. They needed help.

Since publication in "Homing In" and on my Web site, many ham operators have monitored for the radio signals from these threatened birds during fall and spring migration periods. Others, such as "Cactus Charlie" Hoffman K5SBU, have opened their ranch lands to the researchers for this and similar studies. Signals thought to be from owl tags were heard and recorded, but the owls were not verified.

Success finally came in January 2001, as two biologists from Environment Canada flew a Cessna aircraft more than 9,000 miles over the Gulf Coast lowlands and central Mexico. Two signals were heard and later verified on the ground by a pair of Canadian graduate students. One transmitter was under a tree in an orange grove on the side of a small volcanic hill in northern Veracruz state. The ground nearby was littered with owl feathers, indicating that the tag-wearing owl had been killed and plucked by a predator. The finding was surprising, because orange groves are not a habitat for these owls in the USA and Canada. This owl had been banded in Saskatchewan and at least two other living unbanded owls were nearby.

The second transmitter was 250 miles southwest of the first. It was still attached to a live adult male owl that had been banded on the grassy plains of southern Alberta. It and several other owls were in a patch of cactus-thorn shrubland on a hillside surrounded by cornfields and pasture in northern Michoacan, just south of Guanajuato. The tagged owl had traveled 2,175 miles from the location where it had been banded six months before.

Scientists still have much to learn. With ham help, many wintering burrowing owls have been discovered in eastern Texas, especially near Corpus Christi. Are they permanent residents, or do they migrate north in spring and summer? Jerry Batey, a graduate student in Texas, is doing a two-year study to trap, band and place transmitters on these birds to study their dispersal and migratory activities. You can help by monitoring if you live in a central state.

As this issue arrives in your mailbox, the fall migration season is under way, and ham radio volunteers may be needed. Check the "Homing In" Web site to find out the latest Burrowing Owl Project information and active tag frequencies. You'll also find a detailed history of the project and suggestions for equipment and antennas. If you're not on the Web, send a self-addressed stamped envelope (SASE) to me and I'll mail the latest update to you.

CQ saw-whet?

Recently, another researcher has asked for volunteer monitors. Scott Weidensaul of the Ned Smith Center for Nature and Art wrote: "The northern saw-whet owl, named for its rarely-heard call likened to a file 'whetting' the teeth of a saw, is a small forest-dwelling bird that preys primarily on mice and small rodents (**Photo C**). It breeds in thick forest across southern Canada and the northern USA, and down the Rockies and Appalachians. Secretive and rarely seen, it is more often heard: the male's territorial call is a repetitive 'tooting' very much like the backup alarm on large trucks.

"It is the smallest owl species in eastern North America," Scott added. "It weighs barely as much as a robin and stands just 8 inches tall. Saw-whets are common within their range, but their shy nature makes them very difficult to study. Until a century ago, no one knew that they are highly migratory, and until researchers in Wisconsin invented a technique using a tape recording of the male's call to lure them into mist nets, they were very difficult to catch for banding. Much remains to be learned about their ecology and behavior, and radio telemetry is one of the most promising techniques."

Photo D. *After an embarrassing incident, Stockholm's ARDF enthusiasts put plaques like this on their radio foxes instructing passersby to not disturb them or reveal their locations to anyone.*

Photo E. *This radio-orienteering logo, in orange and white, goes on all my ARDF foxboxes.*

This fall, a few saw-whets will be fitted with 1.9-gram radio tag transmitters. The tags, including three-month batteries, are to be attached using a figure-eight harness made of elastic beadwork cord, designed to allow the transmitter to fall off after several months. The tagging site is Schuylkill County, Pennsylvania, about 15 miles north of Reading.

"The Ned Smith team is not attempting to follow the owls in active migration," Scott wrote. "The mountainous terrain in the central Appalachians makes that extremely difficult. The research focuses instead on how the owls behave and live during 'stopovers,' the periods when they take a break from active migration, lasting days or even weeks. Owls that are caught twice within a couple of days are the ones to be fitted with radios. It is hoped that they will stick around at least a few days more, giving researchers a chance to study their habitat use, roost selection and diet.

"In November and December these owls can be expected to either continue south through the Appalachians, or to move south and east into the Piedmont and coastal plain. It is believed that most Saw-whets migrating through Pennsylvania spend winter in the mid-Atlantic states from Maryland to the Carolinas. But little is known about their winter range, and the tagged owls might show up anywhere between the Mason-Dixon Line and Alabama or Georgia, and west through the Appalachian and Cumberland plateaus. If any hams or VHF monitors pick up their signals, it will provide valuable information about where they eventually wind up."

The saw-whet migration begins to pass through Schuylkill County about the first week of October and reaches its local peak around Halloween. It ends by about Thanksgiving in most years, though a few birds may trickle through until after Christmas. Scott's project began with one transmitter on the 172 MHz band in 2000, with more to be fitted this year. To find out the current state of this project, including all frequencies in use, visit the "Homing In" Web site or send an SASE.

Monitoring is only half of the bird-tracking task. Once heard, signals must be positively identified for the data to be useful. Most animal transmitters don't send any "station ID." To provide maximum battery life, the transmitters simply "blip" about once a second. That pulsed signal you hear on your receiver might be an owl tag, but it could be on a completely different animal.

Many local, state and federal agencies use such transmitters. For instance, cougars are collared and monitored in the county where I live. Occasionally they wander down from the mountains into city parks and backyards, where they have killed pets and mauled children. Needless to say, officials want advance warning of their visits whenever possible.

If you have a directional antenna and want to attempt to pinpoint the exact location of a radio-tagged owl, that's great. But keep in mind that these birds must be treated with respect if they are to survive. Observe them only from a distance with binoculars or a spotting scope. Do not disturb them or their burrows. Never forget that other researchers use 172 MHz radio tags, and you might be tracking something much larger and more dangerous than an owl!

If you spot a radio-tagged bird, please observe closely with binoculars to determine if it is banded, plus the band colors and band number, if possible. Note the date, time, exact frequency, your location, and any other distinctive signal characteristics. Make tape recordings or digital audio files if you can. Notify the researchers as soon as possible, using the addresses at my Web site.

All of the Canadian radio-tagged burrowing owls also have aluminum Fish and Wildlife bands with numbers and plastic color bands. Individual owls can be identified by noting the color of the bands and their sequence, as well as which leg they are on. Contact the birding enthusiasts in your area and your local Audubon Society for more information on observation techniques and birdwatching etiquette.

To have the latest information about volunteer wildlife monitoring projects sent directly to your E-mail box and participate in discussions about these projects, subscribe to the "biotrackers" mailing list at Yahoo Groups. Subscription information is at my Web site.

Tracking for dollars and preventing theft

Maybe your radio skills and volunteer monitoring efforts could lead to part-time or full-time employment. E-mail came this week from Terry Hudson KT9V of Solsberry, Indiana, who has put on radio-orienteering events to help train Team USA members. He wrote, "I have had a dream come true for me. I am tracking radio-collared

bobcats with the Indiana Department of Natural Resources (DNR).

"I have one cat that is assigned to me," Terry continued. "I go out three times per week. E-mail in my report to DNR and they put it into a program with the other eight cats that have collars. As I write this, I am heading out to the airport where I will fly with the head biologist in a helicopter with tracking antennas. We are going to locate all the cats by air today.

"I'm having a ball with this. I use my all-mode AOR hand-held VHF receiver in the SSB mode and a homebrew, 5-element log-periodic antenna that I made. My gear works just as well as the DNR equipment, maybe better. I use a GPS set in the UTM mode to provide exact location data to the DNR. With the pulsed transmitters, DNR gets about two years out of a battery on the cats.

"I have been a Telecommunications Supervisor for the Indiana State Police for 25 years and I occasionally get to hunt interference there, but it would be nice to track radio collars full-time. DNR also has transmitters implanted on rattlesnakes and tracks them, but I have not tried that yet. You have to get very close to the snakes, but I still want to do it."

Also in the mailbag recently have been several inquiries from hams who want to know how to label their foxboxes to help protect them from theft or vandalism. In 25 years of competitive T-hunting in southern California, I know of only one ham's hidden transmitter that was stolen. (However, several have been "relocated" by hunters so that the hider ended up having to hunt his own transmitter!) No label is 100% effective, of course, so most huntmasters secure their foxboxes to an immovable object. Inexpensive bicycle chains with combination locks, costing a few dollars at the hardware store, are sufficient.

Nowadays, a greater concern might be a foxbox being mistaken for something sinister or dangerous. A few years ago, I interviewed Per-Axel Nordwaeger SBØBGU about 80-meter foxhunting in Sweden, where the transmitters are in plastic toolboxes with long antenna wires. "We had a competition outside Stockholm not far from the new royal castle," he recalls. "On that island is the most secret radio installation in Sweden. This competition was very close to that area.

"We stopped hearing one of the transmitters and went to investigate. It was on a peninsula in a very swampy area between the mainland and the island. Normally nobody would go out there except silly foxhunters, but two young girls came out in a canoe and happened to find it. They didn't know what it was, so they rolled up the antennas and took it home to daddy.

"I had to go to the police to report the theft because it was close to the military installation. In the meantime, the hunt organizer put flyers on lampposts around the area. One happened to be in front of the house where the girls lived. The homeowner saw it and we got it back, but it took a week. Now we put signs on the foxes." (See **Photo D**.)

If your foxbox is for an international-rules ARDF event, a radio-orienteering logo such as the one in **Photo E** should be prominent on the box. Some groups paint all sides of the box orange and white in this standard orienteering-flag design. I also put a sticker on my ARDF foxes: "RADIO-ORIENTEERING BEACON, DO NOT DISTURB, MONITORING IN PROGRESS" My pager number is prominent on the box, so that a finder can contact me to verify that the device is benign.

If you want to try to scare off a determined (but not illiterate) thief, try a sticker with wording like this: "This radio transmitter is licensed by the Federal Communications Commission. Federal law provides severe criminal penalties for tampering with licensed radio communications equipment. The FBI investigates theft and vandalism to these units."

I always enjoy feedback, foxhunting stories and photos from "Homing In" readers. Send E-mail and postal mail to the addresses at the beginning of this article. Happy hunting!

LETTERS

continued from page 8

This, by the way, is the only time I had ever known about a ham class to go to.

Since I needed a lot of refreshing, I had my 16-year-old daughter, the aforementioned baby we were expecting, go over the test pool questions for Element 2. She learned very quickly — I began taking her to class with me, and on 29 May 01 we passed our Element 2 exams, missing only 3 questions each. On 1 June 01 we were granted our licenses. Mine is KD7NKW, and Catherine's is KD7NKX.

Now, here is what I want you to know. You, Wayne Green W2NSD/1, are my personal hero in ham radio! As soon as I signed up for the class I went to get a new *73*. None at the supermarket. Nor the magazine shop, the ham shop, not even Barnes & Noble or the public library. Some said you were dead. Others said *73* was dead. One said you died together. I scurried around to find all the old *73*s I could. Sure glad I kept a few in the garage.

I didn't like the idea of becoming a ham with no Uncle Wayne around. One morning I happened to have a phone call come in. Next to the phone was one of my old *73s*. I called the number inside and got a real estate office. The lady at the real estate office helped me find your new location and phone number. So, after all of that, here's my subscription! But that's not enough! I want back issues. How about a CD-ROM with every *73* in it? Ever think of that one? I'll prepay, whatever — I just want them all.

I've never met you — I probably never will. — What I want you to know is that I look up to you and respect you. You are the giant voice of sanity and fair play in the world of amateur radio. Subscribing to *73* was to me next in line to the license itself. Right! I haven't even bought an HT for Catherine or me. Another couple of paydays should do it, I think.

Thanks for everything you've done — please don't quit now.

"Aw, shucks," I said, modestly kicking some dirt with my toe. "If they'd had CB when I got started in radio, I'd have been right in there having a ball, just like you did. Why, during the early CB days I often had more luck making contacts with my little CB set in rented cars while visiting new towns than with my 2m HT. When I'd call into a repeater and ask someone to make a phone call for me, I'd get nowhere. On the CB there never was a negatory. Well, this was before cell phones. But, hey, don't tell the hams you work about this, okay? Richard, you and Catherine set up a nice tower and beam, and you'll be sitting there working the Marshall Islands every morning, and with no Candy Company to worry about." — Wayne.

Antenna Tuning at the Speed of Light

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out. The first time I tested my system to include the transceiver I used a dummy load as the antenna. I did this so I could observe the system components and not have RF being radiated. Keep in mind, with a dummy load the tuner will tune up quickly because it sees a near-perfect load. This is a good first test and worth doing. If the system passes the dummy load test, continue

as follows. Next, connect the antenna you're planning to use to the tuner output, with an SWR indicator between the tuner and the transmitter; turn the system on and apply low power (about 15 watts) RF to the system. Then push the TUNE button. The SWR should dance around up and down, the relays in the tuner will clatter, and then the SWR should dip down to a lower reading and the tuner should stop. The system is now tuned; which should take about 3 seconds.

Postscript

You now have experience with a microcontroller and a pulsewidth modulation control system connected by fiber optic cable, giving you a control and antenna system that should tune a wet noodle. I have described how I used this fiber optic control system to operate my antenna tuner. But the use of this system in other jobs is limited only by your imagination. It is a relatively cheap, reliable system which will keep you from running a rat's-nest of wires. It provides complete electrical isolation and gives you several control functions over one path. So use at least a part of what I have created and control the world.

Sources

The Velleman-Kit kits are available from Skagit Whatcom Electronic, 1 (800) 736-7269, [www.Electronic-Supply.com], and others.

For the LED detectors/emitters, fiber optic cable: [Digi-Key.com], 1 (800) 344-4539.

Filters are available from EMI Filter Company, 1-800-323-7990 or [WWW.EMIFILTERCOMPANY.COM]. Part number B7 or similar.

Your Long-Lost Transistor Notebook

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now be removed and should be a thing of the past.

A myriad of computer programs have been developed to perform the calculations for circuit design, and have reduced the amount of time required to perform a design. However, the use of a computer program removes much of the understanding and insight you might desire as to "why choose those values?"

Although the tour covered only the aspects of a Class-A audio amplifier, it did lay the ground work for the more complex design and consideration for working with transistors in an RF environment. To further your understanding of transistors, I encourage you to dig out all of the transistors from your junk box and create sets of characteristic curves for each type. By building a notebook of the data obtained, I firmly believe that your understanding of transistors will soar to new heights. Enjoy, and have fun with your projects!

The QRP Asylum That Almost Closed

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MFJ Enterprises, Box 494, Mississippi State MS 39762. [www.mfj-enterprises.com]

Newkirk, David, "A 40 Meter Regenerative Receiver You Can Build," *QST*, 9/92, p. 35. Reprinted in the ARRL book *QRP Power*, 1996.

NorCal QRP Club, 862 Frank Ave., Dos Palos CA 93620. [http://www.fix.net/~jparker/norcal.html]

Radio City, 2663 County Road I, Mounds View MN 55112. 1-800-426-2891. [www.radioinc.com]

RF Parts, 435 South Pacific Street, San Marcos CA 92069. 1-800-737-2787.

Ramsey Electronics, 793 Canning Parkway, Victor NY 14564. (716)-924-4560. [http://www.ramseyelectronics.com/]

Small Wonder Labs, Dave Benson K1SWL (ex-NN1G), 80 East Robbins Ave., Newington CT 06111 [http://www.smallwonderlabs.com/]

Westgard, E., "QRP Drives Ham Nuts," 73 *Amateur Radio Today*, 3/01, pp. 28–30.

Cleanin' and Climbin'

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positioned themselves beside and above the climber and functioned as coaches. One team member held the loose end of the safety rope and functioned as an anchor (**Photo E**). Terry KC6VCL attended this event.

Hide and Seek: A near vertical rock face with "pigeon holes" was chosen for this event. Natural holes in the rock face provided convenient hiding places for the designated team chip. This was a timed event where the participant would climb to each hole and search for the designated chip and return to the ground in the shortest amount of time.

Upon first arrival at this contest site, a rattlesnake was observed. Of course, a rattlesnake is afraid of people and activity, so it scurried off to hide in the rocks while it had a chance to escape (**Photo F**). Norm K6YPD observed the activities at this event.

Relay: A fairly steep rock face was chosen for this event. Safety ropes were used by the climbers to reduce the danger of falling. Climbers were timed on their speed to climb the rock face, retrieve a chip and return to ground level. The chip was handed off to the next team member who would return the chip to a designated location at the top of the climb. All team members participated in this event to create a total team "time for completion." Doug WA6LXB worked this event.

At the completion of all tasks and the return of the teams to the staging area, prizes were awarded to the winning teams. A raffle having multiple prizes was held for all participants in the cleaning operation so that everyone participating took home a token of the event.

It was nearly 4 p.m. when we packed up our tent and got back onto the road for home.

Talk about a fun day! Judging from the comments and the hearty hugs and handshakes, everyone enjoyed being a participant in the affair. An ample number or photos were taken as a remembrance of the event. For the hams,

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Jim Gray II
[akdhc2pilot@yahoo.com]

Spooky

It appears that October will be slightly better than average for HF propagation, with overall conditions favoring the better side of FAIR. The solar surface ought to remain quiet to unsettled for most of the month, so the geomagnetic index should rarely deviate from "low" to "moderate" or "active" levels.

The greatest potential for instability is from the 22nd through the 27th, with a 60% chance of a CME or strong flare occurring during the period. My guess is that we will observe a moderate proton event on the 23rd, with effects reaching us on the 25th, possibly causing a radio blackout of about 12 hours duration across the higher latitudes. Don't forget to look for bright auroral displays on clear dark nights during these proton "showers." E-mail your questions and comments to [akdhc2pilot@yahoo.com].

Band-by-Band Summary

10/12 meters

Openings progress from east to west with the sun. Look for European or African signals in the morning, Central and South American stations around midday, and Pacific or Asian contacts before sundown. Expect some noontime fading and a short-skip of 1,000 to 2,000 miles.

15/17 meters

DX paths also progress from east to west with the daylight, but openings occur somewhat later. Try Europe before noon, Africa after noon, and Asia or the Pacific in the early evening. Short-skip will average about 1,000 miles with the strongest signals usually peaking at mid-path local noon.

20 meters

Most areas of the world will be workable from sunrise through the early nighttime hours. Peaks often occur just after sunrise and

October 2001						
SUN	MON	TUE	WED	THU	FRI	SAT
	1 F-G	2 G	3 F	4 G	5 F	6 F-G
7 G	8 G	9 F-G	10 F	11 F-P	12 F	13 F-G
14 F-P	15 G	16 G	17 F-P	18 F	19 F	20 F-G
21 G	22 F-P	23 P	24 F-P	25 F-P	26 F-P	27 F
28 F-G	29 F	30 F-G	31 F-G			

EASTERN UNITED STATES TO:												
GMT	00	02	04	06	08	10	12	14	16	18	20	22
Central America	15/17	17/20	17/20	17/20	17/20	15/17	15/17	10/12	10/12	10/12	17/20	10/12
South America	15/17	15/17	20	30/40	30/40			10/12			12/15	12/15
Western Europe	30/40	30/40	17/20	17/20				10/12	10/12	12/15	17/20	17/20
South Africa	20/30	40	20/30	20/30					10/12	10/12	12/15	12/15
Eastern Europe	17/20	30/40	40/80	40/80	30/40			15/17	10/12	15/17	15/17	17/20
Middle East	20	20	20						10/12	10/17	15/17	15/20
India/ Pakistan	17/20	17/20						15/17				
Far East/ Japan	10/12		17/20				17/20	17/20			15/17	10/12
Southeast Asia	15/17		17/20	17/20			17/20	15/17	10/12			15/17
Australia	10/12	17/20	20	20	20	30/40	30/40	17/20				10/12
Alaska	10/12		20				17/20	20			15/17	10/12
Hawaii	10/12	12/15	17/20	17/20	20/30	20/30	17/20	17/20				10/12
Western USA	20/30	20/30	20/30	30/40	30/40			10/12	10/12	10/12	15/17	17/20
CENTRAL UNITED STATES TO:												
Central America	15/17	15/17	17/20	17/20	20/30			10/12	15/17	10/12	10/12	10/12
South America	15/17	15/17	20/30	20/30	17/20			10/12			10/12	12/15
Western Europe								12/15	12/15	12/15	17/20	17/20
South Africa			17/20	17/20					12/15	12/15	15/17	17/20
Eastern Europe	30/40	30/40	30/40						12/15	12/15	17/20	17/20
Middle East	20	20							15/17	15/17	15/17	
India/ Pakistan	15/17	17/20						12/15	12/15			
Far East/ Japan	10/12	12/15	17/20	17/20	17/20		17/20	17/20				10/12
Southeast Asia	10/12		15/20	17/20					10/12	10/12		
Australia	10/12	15/17	15/17		17/20	20/30	30/40	17/20			12/15	10/12
Alaska	10/12	12/15	17/20	17/20	20		17/20	17/20				10/12
Hawaii	12/15	15/17	15/17	17/20	17/20	20/30	30/40	17/20		10/12	12/15	12/15
WESTERN UNITED STATES TO:												
Central America	10/12	12/15	15/17	17/20	30/40				10/12	10/12	10/12	12/15
South America	10/12	12/15	15/17	17/20	17/20						10/12	10/12
Western Europe	17/20				17/20			17/20	17/20	20	20	20
South Africa	17/20	20		20						10/12	12/15	12/15
Eastern Europe	17/20	17/20							15/17	15/17	17/20	17/20
Middle East	20									15/17	15/17	20
India/ Pakistan		15/17	17/20						12/15	15/17		
Far East/ Japan	10/12	10/12	12/15	17/20	17/20	17/20			17/20			15/17
Southeast Asia	10/12	10/12						17/20	15/17	17/20		
Australia	10/12	12/15	15/17	15/17	17/20	17/20	17/20		17/20			
Alaska	10/12	10/12	15/17	17/20	17/20	17/20		17/20	17/20			15/17
Hawaii	10/12	10/12	12/15	15/17	20/30	20/30	30/40		12/15	10/12		
Eastern USA	20/30	20/30	30/40	30/40	30/40			10/12	12/15	12/15	15/17	17/20

Table 1. *Band, time, country chart. Plain numerals indicate bands which should be workable on Fair to Good (F-G) and Good (G) days. Numbers in parentheses indicate bands usually workable on Good (G) days only. Dual numbers indicate that the intervening bands should also be usable. When one number appears in parentheses, that end of the range will probably be open on Good (G) days only.*

again in the late afternoon. Occasional peaks may be found before midnight on Good (G) days. Expect short-skip to be 500 to 1,000 miles during daylight hours and 1,500 to 2,000 miles after dark.

30/40 meters

Occasional daytime openings can be worked (with short-skip up to 1,000 miles), but nighttime will provide the best DX opportunities, especially on trans-equatorial paths toward the south and southwest. Short-skip will vary from 500 to 2,000 miles at night but atmospheric noise from thunder storms will act to degrade signals.

80/160 meters

On Good (G) days you can work more parts of the globe between sunset and sunrise — provided that atmospheric static is low to moderate. Short-skip will average between 1,000 and 2,000 miles, with peak opportunities often occurring along the day/night transition zone (grayline).

Cleanin' and Climbin'

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it was an opportunity to use our talent and equipment in support of a really nice event. Many of the climbers were introduced to "ham radio" for the first time during this event, which made the hams very proud!

Although it was a busy day, the fresh air and moderately warm temperature made us feel invigorated as we traveled homeward bound.

Bear Island on the Air

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We operated the rest of the day, stopping only to paddle over to the ocean side of the island to take a walk on the beach. After dinner we were back at it until 9 p.m., when the band started to die and we went to sleep. It was still early, but four hours of paddling combined with an early start to the day sure wore us out. I gave myself one last spray of bug repellent to keep the black flies off and put my sleeping bag out on the sand so I could look up at the stars for a little while before going to sleep.

At sunrise we began packing the equipment up for the return trip. I was amazed to find the 30-ft.-high antennas that had withstood a lot of wind this weekend were held in the sand with 4-ft. pieces of PVC pipe "screwed" into the sand.

It sure was a weekend to remember, and the rig performed beautifully. I'm already psyched up for the next time that John, Paul, and I can do this. I still want to work Iceland — now, how about with a half a watt on SSB?

SK Night — the REAL Meaning!

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Spaghetti — The hollow insulator slipped over bare wire to protect it from shorting was actually invented by Marconi, I'm told. The original "thin" pasta was a success, but the larger specimens were a failure. To avoid embarrassment and retain the good name of the inventor, shorter sections of the device were created and named after the inventor. Due to a spelling error, though, these will always be known as "Macaroni."

K SK — Operator practices have suggested that we use K SK, following our final transmission for the evening. I assume that this is a "salute" or wave of the hand to prior earthly amateurs, to show proper respect.

Nighttime activity — Why is it that communications seem to be so much better at night! Is it because the previous operators have slept the day away and are now out there communicating? Are all of those stations real? Or are some of them "SK"?

And there you have it! I rest my case. SK Night, as used today to describe a fun-filled evening of hand-generated Morse code, began as something entirely different. Honest.

Calendar Events

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21st. Talk-in on 145.31. VE exams 10 a.m.–1 p.m., all classes. Bring documents. Indoor spaces $12, table included; outdoor $6, bring your own tables. Admission is $5. For more info check the Web site at *[www.rfhill.ampr.org]*, or contact *Linda Erdman, 2220 Hill Road, Perkiomenvilie PA 18074.* Hamfest Hotline *(215) 679-5764.*

OCT 27

ST. LOUIS, MO The 10th Annual Halloween Hamfest will be co-sponsored by The Gateway to Ham Radio Club and the St. Louis ARC, at the Kirkwood Community Center, 111 N. Geyer Rd. Talk-in on 146.31/.91. VE exams, forums, and great homemade food are among the featured items at this event. Admission $1 each, 6 for $5 in advance; $2 each, 3 for $5 at the door. Tables $10. Vendors $15. For more info call *Steve Welton, (314) 638-4959,* or see *[http//www.halloweenhamfest.com].*

WATERFORD, CT The Tri-City ARC will hold an Auction October 27th at the Senior Citizens Center, Waterford Municipal Complex, Route 85, south of Exit 77 off I-395 or north of Exit 82 off I-95. Set up at 9 a.m. Doors open to the public at 10 a.m. Handicapped accessible. Refreshments will be available. Bring your items to be auctioned. Bid cards $1 each. Talk-in on 146.97, PL 156.7. For more info contact *Darryl DelGrosso* at *(860) 443-7799,* or at *[DDelgrosso@aol.com].*

OCT 28

CANTON, OH The Massillon ARC will hold their "Hamfest 2001" October 28th, 8 a.m.–3 p.m., at Stark County Fair Grounds, 305 Wertz Ave. NW. From I-77 N take downtown exit, turn left (W) on W Tusc., turn right on Wertz to Fairgrounds. From I-77 S, take 4th St. NW exit, turn right (W) into grounds. Set up at 6 a.m. Admission $5, under 12 years old admitted free. 8 ft. tables with electric, $10. Handicapped accessible. 32,000 sq. feet indoors and heated. Free parking. Talk-in on 147.18(+) club rptr. For tables, contact *Terry Russ N8ATZ, 3420 Briardale Cr. NW, Massillon OH 44646; tel. (330) 837-3091.* E-mail can be sent to *[w8np@qsl.net].* Visit the Web site at *[www.qsl.net/w8np].*

NOV 10

MONTGOMERY, AL The Montgomery ARC will host the 24th annual Montgomery Hamfest and Computer Show in Garrett Coliseum at the South Alabama State Fair grounds located on Federal Dr. in the North Eastern section of historic Montgomery. Admission $5. Free parking. Inside flea market setup 3 p.m.–8 p.m. Friday evening, November 9th; and 6 a.m.–8 a.m. November 10th. Doors open to the public 9 a.m.–3 p.m. CST. VE exams on site beginning at 8 a.m., by CAVEC. Bring original and a copy of your current license, picture ID

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Calendar Events

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and a $3 fee. Talk-in on 146.24/.84 call W4AP. Ragchew on 146.32/.92 (with phone patch, *up/#down), 147.78/.18, 449.50/444.50, and 449.45/444.45. Flea market reservations required to assure a table. Tailgaters welcome at $5 per vehicle space. For more info write to *Hamfest Committee, c/o 7173 Timbermill Dr., Montgomery AL 36117-7405;* or phone *Phil* at *(334) 272-7980 after 5 p.m. CST.* E-mail *[k4ozn@arrl.net].* Visit the Web site for late breaking news and events, *[http://jschool.troyst.edu/~w4ap/].*

QRP

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too. This choke must be capable of handling the current required by the transistor. Sometimes, collector current can be very high, up to an amp or more, depending on design.

If you're designing from scratch, try adding some negative feedback between stages. This will usually calm things down enough to prevent unwanted oscillations without reducing efficiency.

Look for the stupid things

I worked on a small homebrew transmitter for a week one time. Nothing I seemed to do could fix the problem of the PA taking off. After hours and hours of trouble shooting, I did find the problem: an open in the cable between the RF meter and the dummy load. So, look for silly things like that if you can't find the problem.

Fixing the symptom

When you catch a real knee-knocker cold, you take a cold pill. The pill does nothing for the cold; it will go away on its own. All the pill does is hide the symptoms of the cold.

And one way to fix the symptom of the run-a-way PA stage is to slip a ferrite bead on the base lead. This little bead will almost always stop the transistor from taking off by itself. The problem is still there; we just fixed the symptom!

Another way to fix the symptom is to use a transistor in the PA stage that has an overall lower beta. If you have ever used a 2N3866, you know what I mean. This guy will be quite happy at 400 MHz. It's not the best device to use at 7 MHz. Using a low gain transistor will prevent the stage from taking off, at a cost of output power and overall efficiency.

On the Go

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been disconnected, but a long run of many miles in parallel with a live wire can induce a current in a supposedly safe one. Parallel wires can act like a very large air core transformer.

Likewise, it is best to assume that there may be a gas leak somewhere. I've seen people light road flares to warn of a gas leak. Fortunately I observed that from a distance! It is best to be very careful with any flames or anything that sparks. Speaking of sparks, be very careful of where you put the spare battery packs for your radio. More than one battery pack placed in a pocket or backpack with a set of keys or a toll has shorted and started to smolder.

While most of us might think that we're too careful to make such a mistake, don't underestimate the impact of either adrenaline or fatigue. When a disaster strikes, the adrenaline rush tends to affect our ability to objectively reason. As the event continues and fatigue sets in, we tend to take a few shortcuts in our efforts to get things done. To be effective, we have to be safe. Besides, I always hate to see a fellow ham get hurt when trying to help out.

Never say die

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How about shopping? When you can get an interactive sales video over the Internet, who needs to drive to a shopping mall? Think mail order with unlimited catalogs available.

In the computer business most of the sales these days are being made by a small group of mail order houses. You get their almost weekly catalogs, call in your order, and the next day it's there via UPS. My wife sells her how to dance videos, shipping them via priority mail, so someone who orders a video on Monday often has it in hand by Thursday. Almost anywhere in the country. She sells them via a video preview catalog which shows a little bit of the almost a hundred different videos she has in stock. She even has beginning, intermediate and expert lessons for most of the popular ballroom dances. And the price is right, with each one-hour video providing as much material covered as one would normally get during three hours of personal instruction.

As the Web bandwidth expands she'll be able to deliver her videos to customers who will download them to their DVD recorders. Talk about instant gratification!

Just as my wife has produced her how to dance videos using dancing instructors who have won many awards, we'll be seeing thousands of other skill-teaching videos being made available. Horseback riding? Skiing? Bow and arrow? The top experts of the world will be available to help you build your skills.

How about food? Despite the failure of early Web shopping services, we're going to see our food being delivered instead of our having to drive to the supermarket. As people decide that they would rather eat healthy food than get sick and suffer for years, we're going to see the demise of the food giants. TV dinners, food in cans and boxes will go the way of the cracker barrel of a hundred years ago. I'll get my regular supply of super-organic fruits and veggies delivered to my door. Super-organic means not only with no pesticide sprays or chemical fertilizers, but also grown in remineralized ground — spread with rock dust or Azomite.

Why should I drive a mile or so to a supermarket to shop for fruit and veggies if I can look at their counters via in-store cameras over the Web and make my selections? Their costs will be lower, with one fruit stand doing the work of 100 or 1,000 stores. No expensive store in a shopping plaza. No checkout persons. All automated from warehouses in the lowest of low-rent areas.

With your help we can make this a reality. Or you can concentrate on cheering for your favorite team and let someone else worry about helping us to progress.

Help Wanted

I'm looking for one or two readers to give me a hand solving a problem, and have fun doing it.

The problem is how to get the back issues of the magazine we've got on hand into the hands of readers who will benefit from some of the great articles they've missed.

Sure, I could reprint the tables of contents in a catalog, but I want something more persuasive than that. I'd like to see a short review of the articles in each issue — something that would explain what the articles are about that's more than a title and subtitle, and do it with a sense of humor.

What's it pay? You're asking W2 Never Spend a Dollar about pay for a fun project like this? You mercenary wet blanket. Well, okay, you don't get quality if you don't pay for it, but this'll mean I have to make the customers pay for you to have all that fun. I'd like to

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Wise Up!

Here are some of my books which can change your life (if you'll let 'em). If the idea of being healthy, wealthy and wise interests you, start reading. Yes, you can be all that, but only when you know the secrets which I've spent a lifetime uncovering.

......Wayne

The Secret Guide to Health: Yes, there really is a secret to regaining your health and adding 30 to 60 years of healthy living to your life. The answer is simple, but it means making some serious lifestyle changes. Will you be skiing the slopes of Aspen with me when you're 90 or doddering around a nursing home? Or pushing up daisies? No, I'm not selling any health products, but I can help you cure yourself of cancer, heart trouble, or any other illness. Get this new, 2001 expanded edition (156p). $10 (#05)

The Secret Guide to Wealth: Just as with health, you'll find that you have been brainwashed by "the system" into a pattern of life that will keep you from ever making much money and having the freedom to travel and do what you want. I explain how anyone can get a dream job with no college, no résumé, and even without any experience. I explain how you can get someone to happily pay you to learn what you need to know to start your own business. $5 (#03)

The Secret Guide to Wisdom: This is a review of around a hundred books that will boggle your mind and help you change your life. No, I don't sell these books. They're on a wide range of subjects and will help to make you a very interesting person. Wait'll you see some of the gems you've missed reading. You'll have plenty of fascinating stuff to talk about on the air. $5 (#02)

The Bioelectrifier Handbook: This explains how to build or buy ($155) a little electrical gadget that can help clean your blood of any virus, microbe, parasite, fungus or yeast. The process was discovered by scientists at the Albert Einstein College of Medicine, quickly patented, and hushed up. It's curing AIDS, hepatitis C, and a bunch of other serious illnesses. It's working miracles! The circuit can be built for under $20 from the instructions in the book. $10 (#01)

My WWII Submarine Adventures: Yes, I spent from 1943-1945 on a submarine, right in the middle of the war with Japan. We almost got sunk several times, and twice I was in the right place at the right time to save the boat. What's it really like to be depth charged? And what's the daily life aboard a submarine like? How about the Amelia Earhart inside story? If you're near Mobile, please visit the Drum. $5 (#10)

Wayne's Caribbean Adventures: My super budget travel stories – where I visit the hams and scuba dive most of the islands of the Caribbean. You'll love the special Liat fare which let me visit 11 countries in 21 days, diving all but one of the islands, Guadeloupe, where the hams kept me too busy with parties. $5 (#12)

Cold Fusion Overview: This is both a brief history of cold fusion, which I predict will be one of the largest industries in the world in the 21st century, plus a simple explanation of how and why it works. This new field is going to generate a whole new bunch of billionaires, just as the personal computer industry did. $5 (#20)

Cold Fusion Journal: They laughed when I predicted the PC industry growth in 1975. PCs are now the third largest industry in the world. The cold fusion ground floor is still wide open, but then that might mean giving up watching ball games. Sample: $10 (#22)

Julian Schwinger: A Nobel laureate's talk about cold fusion—confirming its validity. $2 (#24)

Dowsing. Yes, dowsing really does work. I explain how and why it works, opening a huge new area for scientific research with profound effects for humanity. $2 (#84)

Improving State Government: Here are 24 ways that state governments can cut expenses enormously, while providing far better service. I explain how any government bureau or department can be gotten to cut it's expenses by at least 50% in three years and do it cooperatively and enthusiastically. I explain how, by applying a new technology, the state can make it possible to provide all needed services without having to levy *any* taxes at all! Read the book, run for your legislature, and let's get busy making this country work like its founders wanted it to. Don't leave this for "someone else" to do. $5 (#30)

Mankind's Extinction Predictions: If any one of the experts who have written books predicting a soon-to-come catastrophe which will virtually wipe most of us out are right, we're in trouble. I explain the various disaster scenarios, like Nostradamus, who says the poles will soon shift (as they have several times in the past), wiping out 97% of mankind. Okay, so he's made a long string of past lucky guesses. The worst part of these predictions is the accuracy record of some of the experts – like Hapgood, Einstein, Snow, Noone, Felix, Strieber. $5 (#31)

Moondoggle: After reading René's book, *NASA Mooned America*, I read everything I could find on our Moon landings. I watched the NASA videos, looked carefully at the photos, read the astronaut's biographies, and talked with readers who worked for NASA. This book cites 45 good reasons I believe the whole Apollo program had to have been faked. $5 (#32)

Classical Music Guide: A list of 100 CDs which will provide you with an outstanding collection of the finest classical music ever written. This is what you need to help you reduce stress. Classical music also raises youngster's IQs, helps plants grow faster, and will make you healthier. Just wait'll you hear some of Gotschalk's fabulous music! $5 (#33)

The Radar Coverup: Is police radar dangerous? Ross Adey K6UI, a world authority, confirms the dangers of radio and magnetic fields, including our HTs and cell phones. $3 (#34)

Three Gatto Talks: A prize-winning teacher explains what's wrong with American schools and why our kids are not being educated. Why are Swedish youngsters, who start school at 7 years of age, leaving our kids in the dust? Our kids are intentionally being dumbed down by our school system — the least effective and most expensive in the world. $5 (#35)

Aspartame: a.k.a. NutraSweet, the stuff in diet drinks, etc., can cause all kinds of serious health problems. Multiple sclerosis, for one. Read all about it, two pamphlets for a buck. (#38)

$1 Million Sales Video: The secret of how you can generate an extra million dollars in sales just by using PR. This will be one of the best investments you or your business will ever make. $40 (#52)

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COVER: The Space Shuttle *Atlantis* carried the first amateur radio equipment to the International Space Station during the STS-106 mission in September 2000. This was a major milestone for the ARISS (Amateur Radio in the Space Station) program. Photo courtesy of W5ACM.

QRX . . .

Terrorists Strike; Hams Ready

Amateur radio took to the airwaves to provide assistance in the wake of apparent terrorist attacks in New York City and Washington DC the morning of September 11th. More than 300 died in the four hijacked airliner crashes. The number of dead and injured on the ground is still being assessed. Amateur Radio *Newsline*'s Henry Feinberg K2SSQ, was near the scene and had this report:

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Wise Up & Beat the Odds

NEVER SAY DIE

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www.waynegreen.com

A Call to Arms

Since it is unlikely that bin Laden had only one trick up his sleeve, I'm waiting to sec what he has planned for us next. The hijacked kamikaze plane idea was right out of a Tom Clancy novel. It was a surefire attention-getter that required nothing more than a handful of his dedicated followers. No aircraft carriers, no missiles, not even a single gun.

Not that the expense of buying a few of those missing Russian suitcase-size nukes or the anthrax brewing and drying equipment would even make him blink. When the illegal drug industry is able to import hundreds of tons of their product every year, bringing in a few tons of high-tech explosives and some nukes is as easy as it was to hijack those planes. Add to that nasty mix a bunch of fiendish ways to wreck havoc on us that we haven't thought of yet.

We have three Arab groups that are upset with America — the Palestinians, the Iraqis, and the radical Moslems — and all with very good reason. All have billions of dollars available and millions of people to draw upon. So, have we seen the end of the "war"? Not bloody likely.

This war has the potential to strike America anywhere. By surprise at any time.

As we've seen in every serious emergency, one of the first parts of our infrastructure to fail is communications. Phones and cell phones go out. Police, fire, ambulance, and other emergency service repeaters go out, along with power.

The Challenge

We've been having a lot of fun with our repeaters and working DX, but we've let most of our old emergency systems fall apart. I challenge every ham club in America to not sit around and wait for another wake-up call, but to get busy right now in building a local emergency network. Make sure your repeater has emergency power. Have a spare portable repeater available. Heck, even back-to-back HTs can do the job.

I'd like to see every club outfit a van or small truck as an emergency communications headquarters — able to operate on any ham band, and interface with all of the other local mobile services. When there's a major emergency, it's often the hams who enable the fire, police, sheriff, ambulance, doctors, and other mobile services to keep in contact with each other.

Let's see that every ham has an HT handy 24/7. And has practice in using it with emergency drills.

Yes, of course I want to get reports on what your club has done and is doing to be ready for what well may come. Send me pictures of your mobile units.

This could be the first war where hams not only aren't thrown off the air, but will be needed as a basic communications resource. Heck, we're everywhere and we serve at our own expense and without pay.

We're going to need decals for our car windows and patches for our jackets to let the public know that we're providing a volunteer emergency communications service. Let's see what you can come up with for a design, and I'll make 'em available.

Toldja So

Okay, all you guys who have been snickering about gloom and doom Wayne for writing about the coming terrorist attacks on America. Are there really a hundred Iraqi eleven-person cells around the country making large batches of anthrax? The equipment needed is simple, relatively inexpensive, and easily purchased. Like those manure-made bombs. Duncan Long's 1998 Bioterrorism large-size inch-thick book is overpriced ($79), but it's packed with the grim details on germ warfare (anthrax, bubonic plague, smallpox, etc.) and sources of protective clothes and masks.

One of the FBI agents who managed to infiltrate one of the cells reported that their goal was to kill over 250 million Americans within a few days. The bad part is that their plan is doable.

Senators Hillary Clinton and Warren Rudman both brought up in TV interviews the potential for us to experience nuclear, chemical, and germ terrorism, so it isn't just old, crazy, conspiracy-theory, gloom and doom Wayne with this message.

For a fraction of the cost of one fighter jet, a terrorist attack could kill a couple hundred million Americans.

Cities

I've been recommending that people get the heck out of our major cities for years. Now a few million people are going to think more seriously about it. Cities are sitting ducks for nukes, bombs, and germ attacks. They're also a lot more stressful for daily life. I lived in New York City (well, the Borough of Brooklyn) for 30 years, off and on — mostly on. My folks moved there in 1933 when Tommy Luddington and Amelia Earhart sold Luddington Airlines to Eastern Air Transport. My dad had been the passenger and cargo manager of the airline and was suddenly out of work, right in the middle of the Depression.

So we moved in with my mother's folks in Brooklyn and dad got busy starting a new airline using flying boats between downtown Boston and downtown Manhattan. EAT and TWA invested in Marine Airlines as a way to bring Boston customers to their flights.

Then Pan American's Juan Trippe, worried over the starting of another flying boat airline, got his good buddy President Roosevelt to issue a Presidential Order saying that no airline could invest in another airline. Poof! There went Marine Airlines.

Dad then went to American Export Lines, America's largest steamship line, and convinced them that vacationers

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'The city remains completely shut down. No access to any bridges, tunnels or subways. F-16 aircraft are flying very noticeably in New York airspace — patrolling. We are literally under military and federal control and the governor has mobilized the National Guard."

Those were the words of one New York area ham familiar with emergency communications. He was describing by E-mail the situation late in the morning of Tuesday September 11th after what are believed to be terrorist-launched attacks against New York City and Washington DC.

Almost immediately after the apparently coordinated assaults, President George W. Bush announced that the US military was put on high alert here in the United States as well as abroad. At about the same time the Department of Transportation issued a nationwide notice closing off all domestic air traffic.

The FCC did not issue an emergency declaration or other special instructions to the amateur radio community, but the American Radio Relay League asked amateurs to stay alert to instructions from local authorities. And the ARRL said that hams WERE ready to assist in any way that they could.

In the Metro New York area, some ARES and RACES organizations opened emergency nets in response to the disaster. According to ARRL Section Emergency Coordinator Tom Carrubba KA2D, a net was set up on the WB2ZSE repeater with Guy Richman KC2AYG as its control station. The net handled emergency traffic and provided hams to shadow some New York City officials. Meantime, Kenneth Goetz N2SQW reported that New York State RACES nets were operational on 7.248 MHz and 3.993 MHz. Both nets handled emergency and government-related traffic.

In the Washington area, Maryland and DC Section Emergency Coordinator Mike Carr WA1QAA told the ARRL that RACES groups were activated in Montgomery County and put on standby in Howard County. Montgomery County Deputy Radio Officer John Creel WB3GXW reported that that county's RACES team was activated and under full tactical alert. Also, Virginia SEC Tom Gregory N4NW asked everyone to monitor the emergency frequencies and to keep a full tank of gas. The Old Dominion Emergency and Virginia Emergency nets were said to have been active.

At times like this, one group the nation always turns to is the Salvation Army. That organization reported that its Salvation Army Team Emergency Radio Network activated its high frequency net on 14.265 MHz. SATERN also handled health-and-welfare inquiries sent in via its Web site.

Meantime, the FCC's Riley Hollingsworth suggested that the amateur community remain calm but to be ready. He also recommended that amateurs monitoring any suspicious communications tape them and contact him. Hollingsworth says that he will relay relevant information to the FCC duty team.

One question on the minds of many hams is what will happen to the hobby if our government declares war in retaliation for this terrorist act. The American Radio Relay League advises that should a state of war be declared, amateur radio would not automatically be shut down. The League says that this requirement was eliminated prior to the Gulf War.

The September 11th attack also took most broadcast television off the air as well. Also destroyed were several radio station transmitters and a few amateur repeaters. And now its been learned that there was a human loss for ham radio as well.

The *ARRL Letter* reports that at least four Amateur Radio operators are among the many still missing in the aftermath of the attack. They include Steve Jacobson N2SJ, age 53, of New York City. Jacobson worked as a transmitter engineer for WPIX channel 11. Also, on transmitter duty at the time of the attack was Bill Steckman WA2ACW of West Hempstead out on Long Island. He is employed by WNBC channel 4 and is well known in the area for a number of repeaters he operated from the World Trade Center. Most notable among them a 434 MHz ATV system.

Another missing ham is Robert D. Cirri, Sr., KA2OTD, of Nutley, New Jersey. Cirri is a Port Authority police officer and the ARRL District Emergency Coordinator for Hudson County. He was last seen helping to evacuate workers from one of the buildings when it collapsed.

Also: Michael G. Jacobs AA1GO of Danbury, Connecticut, who works at Fiduciary Trust Company International, which had offices in the World Trade Center. He too has not been seen since the twin towers collapsed.

So sadly, we may learn of more.

As to over-the-air television in the New York City metro area, Bob Gonsett's *CGC Communicator* newsletter reported that only WCBS channel 2 was on with any really wide coverage signal. Unlike all other broadcasters that made the move to the World Trade tower back in the 1970s, WCBS decided to maintain its longtime transmitter site on the Empire State Building as an offsite back-up. When everyone was put off the air by the World Trade Center collapse, WCBS switched over to its Empire State Building site. It immediately became the lifeline of information to a city that needed to know what was happening.

Meanwhile, other broadcasters were scurrying to find and transport new or used transmitters to the Empire State Building where some still have their old antennas and feeder lines on the Empire Tower. WCBS offered assistance and space to help the stations get back on the air from the Empire State Building site. Both Canadian transmitter supplier Larcan and American manufacturer Gates had high-power VHF transmitters available and were reportedly shipping same.

Out west, because three of the four involved aircraft in this attack had Los Angeles as their destination, both the LAPD and the Los Angeles County Sheriff's Department went on tactical alert the morning of Tuesday the 11th. This activated the EOCs, the Emergency Operation Centers, and therefore the LA County version of RACES, the DCS or Disaster Communications Service, swung into action.

There's a multiband amateur radio station set up in or near the EOC in each of about 25 sheriff's stations around the LA area. There are also stations set up at major industrial facilities, such as NASA's Jet Propulsion Laboratory in Pasadena. These stations work with the EOCs in coordinating traffic with other county and city agencies, hospitals, and the Red Cross. All stations were up shortly, with almost 100 hams also checking in from field locations.

Back in Washington, the FCC headquarters at the Portals in southwest Washington was temporarily evacuated Monday morning, September 17th. This, after an unidentified package was discovered and checked out. According to the *CGC Communicator,* the incident occurred at about 10:15 a.m. eastern time. FCC spokesman David Fisk says that the employees were evacuated as a cautionary measure. About 10 minutes later an all-clear signal was given and employees were allowed back into the building.

Support for the people of the United States is coming from every corner of the world including the nations of the Middle East. And now one nation's society in that region has gone a step further.

Effective September 15th the Kuwait Amateur Radio Society, in conjunction with the Kuwait Ministry of Communications, authorized the use of the callsign 9K2USA. According to Bob Furzer K4CY, who is in Kuwait and licensed as 9K2ZZ, all ham operators in Kuwait would be using the 9K2USA call on all bands, on all modes simultaneously through the end of September. This, says Furzer, as a small token of the sympathy and support for the people of the United States from the people of Kuwait.

From Australia came more outreach, the words of Wireless Institute of Australia Federal President Earnest Hocking VK1LK, sent to all of us via ARRL President Jim Haynie W5JBP as Hocking expressed his feelings on the terrorist attack against our nation:

"It was with great sadness that I heard the news of the attack on New York, the Pentagon, and other U.S. sites. As many have already said words simply fail us at times such as this.

"As the representative of the amateur radio community in Australia, I believe that I speak for all radio amateurs when I extend my condolences and thoughts to all of the victims and their relatives of this attack. I have no doubt that many American amateurs and their families have been directly affected by this cowardly act of terrorism, and I would like to express my personnel feelings of sadness to these members of the amateur radio community.

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NEVER SAY DIE

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would eventually be flying to Europe and that they'd better get involved. Thus started American Export Airlines and its transatlantic service — which lasted through WWII, until Juan Trippe got Roosevelt to issue an Executive Order saying that no steamship line could own an airline. Pan American bought the airline for peanuts.

By the way, the comparisons of the World Trade Center attack to Pearl Harbor are baloney. As I wrote recently, Robert Stinnett published the documents in his *Day of Deceit* that nailed Roosevelt for having intentionally forced the Japanese into attacking us in order to get us into the European war. He knew exactly where the Japanese carrier fleet was, and their target. He replaced the smart general and admiral at Pearl with incompetents and then kept all information on what was going to happen from them. He also arranged for our carriers to be away, leaving some old and no longer needed battleships to be targeted. At the cost of only about 5,000 lives, Roosevelt got the American public to clamor to go to war.

Anyway, getting back to cities. Any place there are millions of people all in one small area makes a great enemy target. Two hijacked airliners were able to kill thousands of Americans. Imagine what spraying some anthrax from the Empire State Building and around the airports and subways could do!

And the first thing the authorities did was close all bridges and tunnels and shut down the subways, making it so that New Yorkers were completely trapped. That's okay for a day, but a city without power, water, and food would soon be a death trap for millions. No city has a highway system that would let more than a few thousand people escape, even if the authorities left them open, which is most unlikely. They would be commandeered for emergency traffic.

My advice? Do as I did and move to the sticks somewhere. Stay away from people concentrations like those towers. No one is going to bomb Peterborough, where the highest concentration of people is at Nonie's Diner.

Cities are becoming less and less safe places to live and work.

In the meanwhile, we've got to get as many of our 600,000 licensed hams into our emergency groups and trained. We need to interest a lot more people in our hobby/service. We want to be able to provide community and long-range communications no matter what emergency comes along, whether it be another enemy attack, that promised global super-storm, or a sudden pole shift.

This is our opportunity to justify the billions of dollars of radio frequencies we hold. Now, turn off the TV, get off that sofa, and get busy. And let me know how you're doing.

Schooling 2020

These are the pioneering days for distance teaching, whether it be via books, tapes, CDs, DVDs, seminars, the Web, or videotapes. I envision the DVD programs of 2020 using professional actors and writers, coupled with the magic of animation. How about a virtual electronics lab where circuits can be soldered together and tested?

Looking over the field, the outfit which could bring us the best in educational products right now is Apple Computer — by virtue of Steve Jobs' Pixar connection.

A few letters from me get shunted off to their legal department. They send me form letters saying that Apple is not interested in discussing new ideas. Maybe

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Letters

From the Ham Shack

Hal Camlin W3QLP. Wayne, I am the guy who first told you about WinLink 2000. I am glad to see that Jack Heller wrote a great article in "The Digital Port" department of your September issue of *73*. It was the most informative "how-to" that I have seen on the subject.

In the QRX section of the same September *73*, there was a short article titled "The Greatest Generation." It was a well-written article about LST 325, but the writer failed to point out that the communications of KC6WYX, Jack Carter, LST 325 XO and retired USNR CDR and electrical engineer, included sending E-mail messages of the ship's log via WinLink 2000 (see September, 2001, *73*, "The Digital Port," "WinLink 2000 and the Airmail Package" by Jack Heller KB7NO) to nonhams to appear on the ship's Web site.

Also, the Web site was not 1st887/1st325, but lower case LST887/LST325. Thus: [www.palosverdes.com/lst887/lst325.html]. When LST 325 sailed across the Atlantic, unescorted with a crew of 29 whose average age was 73, and into Mobile AL, on January 10, 2001, they expected about 500 relatives and friends to meet them. However because of ham radio communications, WinLink 2000 communications and the news media, there were over 10,000 greeters.

It is sad that Jack Carter KC6WYX became a silent key on February 20, 2001, because of cancer, at the age of 71. He will be remembered by many as the ham operator that proved the versatility of WinLink 2000 as being the shot in the arm that amateur radio needs to compete and join in with computer/Internet communications. 73.

SK. William "Bill" Chapman W8TJQ was born on July 30, 1922, in Plainwell, Michigan. The son of Leland and Jeanetta (Webber) Chapman, he died Monday, August 6, 2001 at Ingham Medical Center. Bill was voted "most curious" by his high school classmates, and this trait was a defining feature of his life. He lived his life asking questions and learning new things, and encouraged his family to do the same. Bill served as a radio operator on merchant marine ships during World War II, making the dangerous Murmansk run several times. He graduated from Western Michigan University in 1949 and taught physics and math at Augusta High School where he also coached varsity basketball, taking his team to the 1950 state finals. Bill worked at Wedemeyer's Electronics in Lansing for 30 years. He was a devoted MSU sports fan, attending every home basketball game since 1951. Bill had many hobbies: He played trumpet and banjo in a college jazz band, was a member of S.P.E.B.S.Q.S.A., had his own plane and loved to fly, was an active participant in the Central Michigan Amateur Radio Club as W8TJQ with an Extra Class license, and engaged in tournament cribbage. He loved the friends who joined him in these activities. Bill was a worldwide traveler, but also enjoyed fishing at the cottage he built in northern Michigan. Bill married Mary Louise Stauffacher, who survives, on July 14, 1945. Together they raised seven daughters: Anne Martin (Ralph), Margaret Chapman (Bjorn Dag Gundersen), Mary Trese Cook (Mark), Elizabeth Murray (Mark), Bernadette Leone (Lucian), Jennifer Quinine (Patrick), and Jane Samaniego (Christobal). Bill cherished his 21 grandchildren and 3 great-grandchildren. Memorial contributions can be made to Mother Teresa House for the Care of the Terminally Ill, P.O. Box 13004, Lansing MI 48901, in memory of William W. Chapman.

Mike Miller WA8YKN. I'm sorry to report that my old ham radio and gunsmith mentor of many years, Tom Stence W8NQD/KN8B, has become a silent key.

Tom was born in 1910, and had enjoyed ham radio since its most exciting and magic early years. He taught me how to build my first regenerative detector, and helped me build my first CW transmitter. He administered my Novice and Technician exams back in 1967.

By watching Tom at work, I learned to operate the lathe, mill, and drill press, and many times saw him make a required tool on the spot to complete a difficult job. He always said, "A machinist can make tools, but tools can't make a machinist." He was a true artist in wood, brass, and steel back in those days, and made some of the most beautiful rifles I've ever seen.

Tom was also a writer, although his work seldom went any farther than his friends. I have a magazine from many years ago in which he sent a wonderfully funny letter to the editor, who presented it unabridged as an entire column. It's a classic. I see a bit of Tom's writing style in my own articles from time to time. When I complain that it's easier to find a clutch of auk eggs than a repair part for a modern ham rig, that's Tom peeking through.

Growing up around Tom's shop has had an effect on the way I look at problems and arrive at solutions. ... I wouldn't be a ham, an author, or an engineer today were it not for him.

Norm VK5GL. QRP is enjoying a renaissance — show the kids how to make receivers for almost no cost but a lotta fun, and us licensed hams how to make one-transistor transceivers and linear amps from one power transistor. I'd really, REALLY, like to know how to make a 10 gig transceiver from the motion detectors. (I have two — I only need someone to show me how!) If I had the money, I'd send a subscription to the mag to the science club at the local high school. Oh, Wayne — I could go on all night on getting folks off their butts and starting to live a healthy lifestyle. Here we are going to be shoveling it up-hill I fear. As for me, my wife and I did the drastic and at nearly 60 years young moved to an acre of paradise out in the donga where I can grow my own veggies and raise my chickens as well as run my desktop publishing business. I do work for the local area, which is rural, wine- and olive-growing. Truly, I have NEVER in my life felt better, and bear in mind that I was born in a bomb shelter during one of the frequent visits by the Luftwaffe over Liverpool! Your editorials, Wayne, are really inspirational and mean a lot to me. Keep on keeping on!! God bless!

Arnold Samuels, Ocean Shores WA. It is again my sad duty to advise you of the death of a good friend, Gary Paul Anderson N7JPG. Gary passed away April 27th, 2001, at the age of 60. He was born September 12th, 1940, in Spokane WA.

Gary loved the sea. He was in the U.S. Coast Guard and was a U.S. merchant marine seaman and officer from 1957 through 1971. He owned a charter boat called *Maverick* and was captain for the charter fishing vessel *Neddie Rose*. He was an outstanding mechanic and helped me several times, repairing my antenna tower and rotator. He belonged to the Grays Harbor Amateur Radio Club and the Masonic Lodge Franklin Lodge No. 5, Port Gamble WA. He lived in Westport WA until the time of his death at the VA hospital in Seattle.

HAMSATS

Amateur Radio Via Satellites

Andy MacAllister W5ACM
14714 Knights Way Drive
Houston TX 77083

Welcome, Newcomers!

You are about to embark on a journey into the fascinating high-tech world of satellite communications. It won't cost thousands of dollars, and you don't even need a satellite TV dish. Just bring an open mind and an active curiosity.

The Space Age began on October 4, 1957, when *Sputnik I* achieved orbit and became the world's first artificial satellite. Though international tensions rose, so did the excitement as scientists and engineers speculated on the potential of the man-made orbiting device. This was a radio in space. Hams took note.

A year and a half later, Don Stoner W6TNS mentioned a solid-state six- to two-meter repeater with solar power in his "Semiconductors" column in the April 1959 issue of *CQ* magazine. The repeater was to be lofted by balloon over the Southwest. Don wrote, somewhat tongue-in-cheek, "Can anyone come up with a spare rocket for orbiting purposes?"

On the morning of December 12, 1961, OSCAR-1, amateur radio's first "hamsat," began transmitting from space. It's been 40 years.

Today, we have several hamsats. They have been built by amateur-radio enthusiasts all over the world. UoSATs from Great Britain. Fujis from Japan. RS units from Russia. OSCARs by the U.S., West Germany, and others. They are in orbit now, just waiting for you to join the fun and use them.

All have telemetry output, and many have transponders for communications. Earth stations range from shortwave to UHF and microwave systems.

In this special satellite issue, you will find construction articles, satellite profiles, and informational topics on all facets of the amateur satellite program. Details of the program's history can be found on-line at [http://www.amsat.org], in the *ARRL Handbook* and *The Satellite Experimenter's Handbook*. Our purpose is to show you how to get on the satellites today and what to expect tomorrow.

New satellites are being readied for launch from many sources. Packet radio from space, digitized TV pictures from low-earth orbit, voice synthesizers with two-meter FM downlink operation, and other modes will make 2002 a banner year for AMSAT and its international affiliated organizations.

Care to know more? Read this issue! It's all here. You may find that your shack already has all the equipment needed for full-duplex amateur radio satellite activity. Join the fun in using the highest repeaters around. Make your next contact an *OSCAR* contact!

Glossary

AMSAT — The Radio Amateur Satellite Corporation, whose purposes include satellite construction and education as a nonprofit membership-funded entity. For details call (301) 589-6062, write to P.O. Box 27, Washington DC 20044, or check it out on the Web at [http://www.amsat.org].

AOS — Acquisition of Signal. When the satellite has appeared above your horizon for a pass.

AO-10 — AMSAT-OSCAR-10. The first amateur high-orbit communications satellite, launched in 1983. AO-10 is still on the air providing limited, but useful, linear transponder operation for voice and CW via Mode "B" — 70-cm up and two meters down.

AO-27 — AMRAD-OSCAR-27. A very popular low-orbit microsat with a two-meter to 70-cm FM crossband repeater system.

AO-40 — AMSAT-OSCAR-40. Our most recent amateur-radio high-orbit communications satellite. In spite of damage to some systems that occurred in December 2000, this hamsat has numerous experiments and systems that are fully functional.

Apogee — A satellite's position when it is farthest from the earth's surface.

ARISS — Amateur Radio on the International Space Station. The current gear is in use on two meters with packet and voice.

Downlink — The space-to-earth signals coming from a satellite.

Doppler Shift — The apparent frequency shift of signals as retransmitted through a satellite transponder.

FO-29 — Fuji-OSCAR-29. An amateur-radio satellite built by hams in Japan and launched on a Japanese rocket.

Full Duplex — The ability to listen to your own signals as retransmitted via satellite.

Hamsat — Another name for an amateur-radio satellite.

Keplerian Elements — A set of numbers used to define a satellite's orbit. Most tracking software requires these numbers to determine satellite availability.

LOS — Loss of Signal. When the satellite has completed its pass and has fallen below your horizon.

Mode — A letter description of a particular uplink/downlink frequency combination for a satellite transponder. For example: Mode "A" defines a two-meter uplink and ten-meter downlink operation, while Mode "US" defines a transponder with a UHF uplink (70 cm) and an S-band downlink (13 cm).

OSCAR — Orbiting Satellite Carrying Amateur Radio.

Perigee — A satellite's position when it is closest to the earth.

RS-12/13 — The most popular Russian hamsat. These two devices are a part of the navigation satellite. They are a continuation of the Radio Sport series begun in 1978 with RS-1 and RS-2.

Telemetry — Data transmitted by the satellite describing the health of the onboard systems. The format can be CW, RTTY, ASCII, PSK, or even synthesized voice.

Transponder — A linear "repeater" on a satellite that retransmits signals from one band to another. For example: An RS mode "A" transponder takes a 40 kHz portion of two meters and translates it to a 40 kHz portion of 10 meters.

UO-11 — UoSAT-OSCAR-11. The second University of Surrey hamsat was designed, built and launched in six months. Launched in 1984, this hamsat continues to transmit telemetry on 145.825 MHz FM at 1200 baud.

UO-14 — UoSAT-OSCAR-14. Built by hams at the University of Surrey in England, this low-orbit scientific/educational satellite is currently operational as a very popular crossband FM repeater with a two-meter uplink and 70-cm downlink.

Uplink — The earth-to-space signals sent to a satellite.

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Practical RF Ground Stations for AMSAT AO-40

All you need to know.

AMSAT AO-40 is an exciting opportunity for the amateur satellite world. Its high elliptical orbit and consequent large visible footprint enables reliable intercontinental communications to be made using small, low-power, ground stations. AO-40 is of particular interest to a microwave amateur as it's the first amateur satellite to use microwave transponders for its primary communications platform.

In spring 2001, the first transponder tests were carried out; they were immediately successful with stations around the globe using AO-40's 70cm, 23cm uplinks and 13cm downlinks. These tests proved that AO-40 was going to be a huge success; this is particularly pleasing considering the uncertain start to life that the satellite had come through!

With the orbital maneuvers now complete and magnetorquing bringing the satellite back in a favorable orientation for transponder operations, it is fitting that *73 Magazine* has chosen this point in time to produce another "satellite special," and especially pleasing to be invited back to participate in this issue.

In the following piece, I will outline what equipment is required in the RF parts of an AO-40 ground station and where to obtain these items, plus give some hints and tips to help guide you to your first successful AO-40 contacts.

Currently, only the 70cm and 23cm uplinks are in operation: downlinking is via the 2.4 GHz band. Other transponders have been tested, but results have been inconclusive and further work is required to complete a detailed analysis of their status. So for the purpose of this article, I will be concentrating on what is actually available to operate on, i.e., 70cm and 23cm up and 2.4 GHz down.

Transponder configuration

Tables 1–3 show the transponders carried by AMSAT AO-40. These transponders are connected via a transponder IF matrix which allows any combination of uplink to be connected to any combination of downlink. Two separate combinations can be utilized, allowing two wholly separate configurations to be operated at the same time. Unfortunately, it is not yet known if the VHF/UHF transponders are still operational, so currently only the 70cm/23cm/2.4 GHz combination is being utilized, known as Mode UL/S.

The transponders are linear devices and thus allow the use of narrowband modes, i.e., SSB/CW or narrowband data (PSK31, etc.). In fact, the use of FM is frowned upon as it uses

Uplink	Digital (MHz)	Analog Passband (MHz)
15m	none	21.210–21.250
12m	none	24.920–24.960
2m	145.800–145.840	145.840–145.990
70cm	435.300–435.550	435.550–435.800
23cm(1)	1269.000–1269.250	1269.250–1269.500
23cm(2)	1268.075–1268.325	1268.325–1268.575
13cm(1)	2400.100–2400.350	2400.350–2400.600
13cm(2)	2446.200–2446.450	2446.450–2446.700
6cm	5668.300–5668.550	5668.550–5668.800

Table 1. AO-40 transponder band plan. P3D uplink frequencies.

Downlink	Digital (MHz)	Analog Passband (MHz)
2m	145.955–145.990	145.805–145.955
70cm	435.900–436.200	435.475–435.725
13cm(1)	2400.650–2400.950	2400.225–2400.475
13cm(2)	2401.650–2401.950	2401.225–2401.475
3cm	10451.450–10451.750	10451.025–10451-275
1.5cm	24048.450–24048.750	24048.025–24048.275

Table 2. AO-40 transponder band plan. P3D downlink frequencies.

Beacon	General Beacon (GB) (MHz)	Middle Beacon (MB) MHz)	Engineering Beacon (EB) (MHz)
2m	none	145.898	none
70cm	435.438	435.588	435.838
13cm(1)	2400.188	2400.338	2400.588
13cm(2)	2401.173	2401.323	2401.573
3cm	10450.975	10451.125	10451.375
1.5cm	24047.885	24048.035	24048.285

Table 3. *AO-40 transponder band plan. P3D telemetry beacons (IHU). Beacon frequencies have been measured before launch at Kourou and may change due to aging, vibrations, or temperature. 2m-MB and 13cm (2)-MB have already been measured in orbit. Remarks for tables: All receivers are inverting! Telemetry beacons are for command purposes and are modulated in 400 bit/s BPSK, AMSAT format. The MB can be switched between IHU-1 or IHU-2 telemetry.*

wideband widths and is a high-duty mode, which utilizes a lot of satellite power (so it is classed as unneighborly). So to operate on AO-40, some form of multimode SSB and/or CW uplink and downlink capability is required.

Station design

Putting together a station for AO-40 is not really "rocket science," excusing the pun! But its design really depends on whether you want to buy new, have existing equipment you can use, or wish to buy older equipment, perhaps purchased secondhand.

Buying new is an expensive way of getting onto AO-40. Simple as that! There are a number of modern dual-band VHF/UHF multimodes that would be suitable but are very expensive and would still need additional equipment added to become operational on AO-40. So far there is no commercial VHF/UHF transceiver with a 2.4 GHz receive capability built-in.

The second option is to consider using existing equipment in your station. You may already own a dual-band multimode or separate VHF-UHF multimodes. If you own this type of station, it could be quite simple to add a downconverter and some antennas and be up on the satellite quite quickly.

The best, and cheapest option, really, is to buy secondhand items and put together a station this way. It will perform just as well as new, but costs considerably less.

So let's look at what is required for a Mode UL/S AO-40 ground station.

Fig. 1 shows a UHF up/2.4 GHz down station and demonstrates the simplest station available for full AO-40 operation.

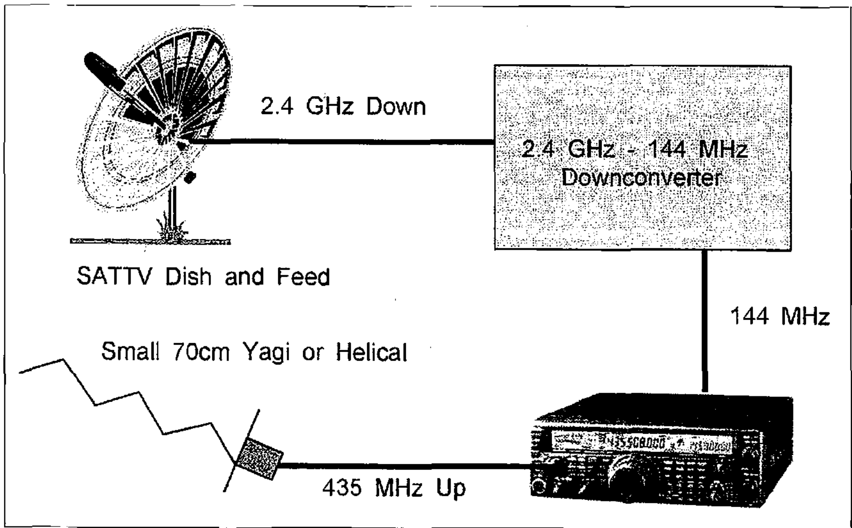

Fig. 1. *AO-40 Mode U/S satellite station.*

In this station, a 2.4 GHz downconverter is added and connected to either a 2m multimode or the 2m part of a multiband multimode. The 70cm antenna is connected to either a 70cm multimode or 70cm port of a multiband radio.

Ideas for antennas for both uplink and downlinks can be found elsewhere in this issue.

A more complicated station is shown in **Fig. 2**. This allows use of the L band uplink (1269 MHz). This is particularly useful if you own a 23cm radio or module for one of the multiband radios such as the Yaesu FT-736R or Kenwood TS-790.

Mode L — buy/build?

For most people, the purchase of a dual-band radio will not present any technical problems, but the 23cm uplink could be unknown territory for some. A word of advice here. There is nothing special about microwaves — it is simply a case of learning some new skills and techniques. Once you are over the hurdle of microphobia — the fear of anything small, such as microwaves! — you are high and dry!

So let's consider some options for 23cm.

If you own a multiband radio such as the FT-736, TS-790, or even the new IC-910, then adding a 23cm band module may be the easiest route, although it could never be classed as the cheapest. As an alternative, a single-band 23cm radio could be purchased, although these were never produced in massive amounts and can be hard to obtain.

Probably the easiest option is to buy or build a 23cm transverter. This will allow conversion in both transmit and receive to 1269 MHz from either a 28 MHz or 144 MHz transceiver. There are quite a few models available ready-built from sources such as Down East Microwave, DB6NT, and SSB Electronics. All are suitable for use on AO-40.

An alternative to a ready-built model is a kit. Building a 23cm transverter is not a major issue if you can handle a

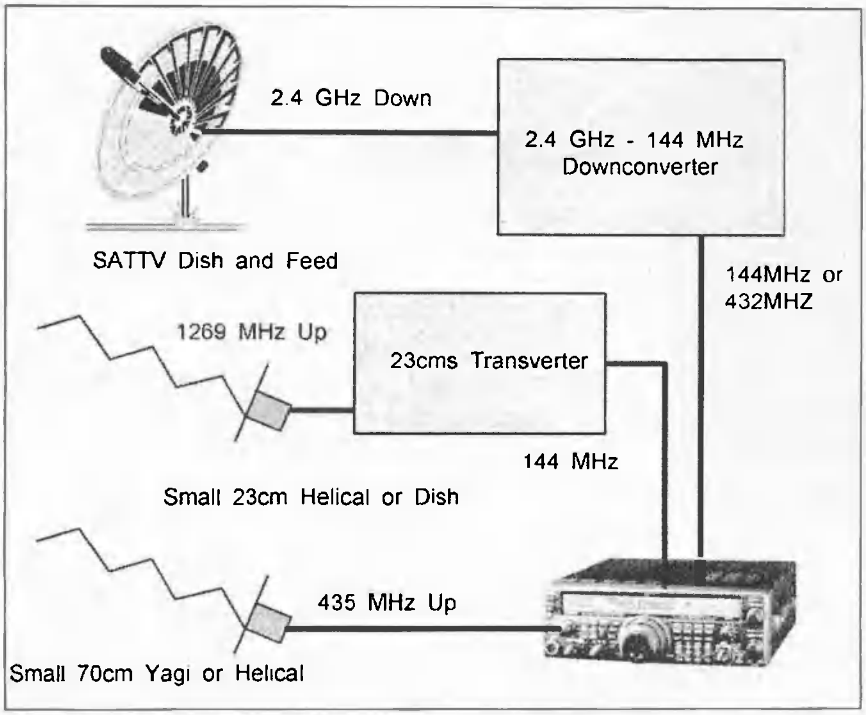

Fig. 2. AO-40 Mode U/L/S satellite station.

soldering iron competently and follow a simple set of instructions to the letter. Most modern transverters are of single board design with either an onboard local oscillator or an external oscillator. Single board refers to the design concept that puts both transmit and receive stages on the same PCB. The transverter normally accepts low-power RF from a transverter and converts this signal to the 1296 MHz band. The receive function operates in a similar manner, converting received signals at 23cm to the 144 MHz band transceiver. The transverter normally contains DC voltage switching and the IF transceiver switching circuits.

There are a variety of kits available from a number of sources, many of which can be found on the Internet.

The G3WDG 23cm transverter (**Photo A**) is a typical example of a single board transverter design. The PCB carries the RF and DC switching. It uses an external local oscillator at 1152 MHz. In my station, this is provided by a G3WDG surface mount oscillator. Low-power RF from an FT-90 is fed into the transverter and mixed to 1269 MHz. This is filtered and amplified to produce RF at around 10 mW. In my station, the WDG transverter is

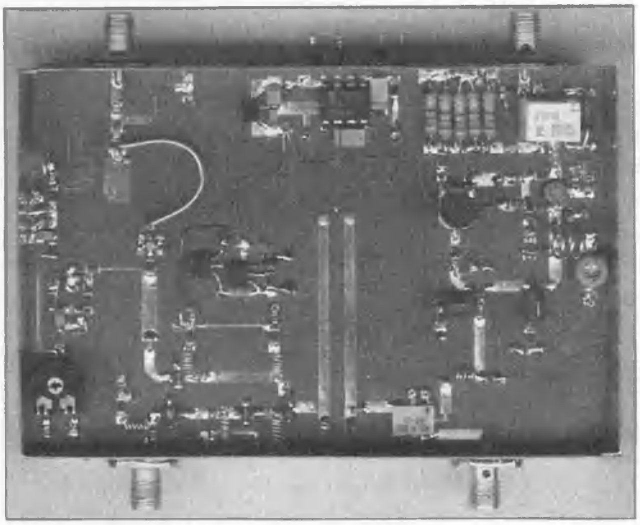

Photo A. G3WDG 23cm transverter.

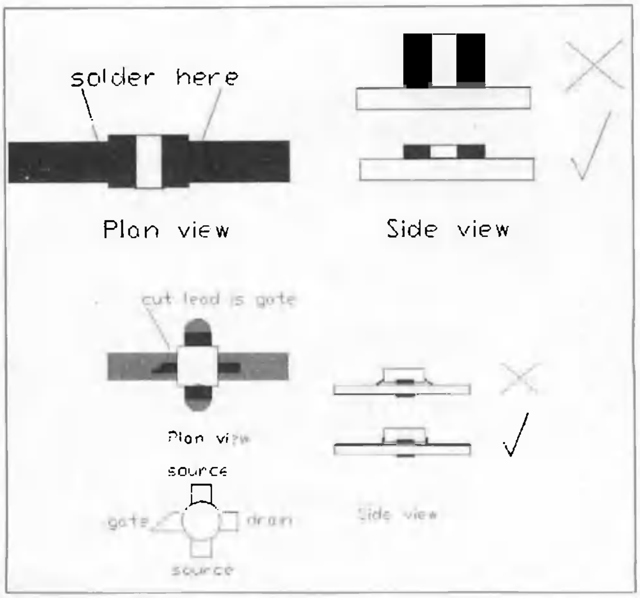

Fig. 3(a/b). Surface mount component placement.

used solely in transmit for AO-40 purposes.

Building this kit is fairly simple. The kit is mounted in a small tinplate case that provides screening and a rigid mount for the PCB and connectors. The case is soldered together. Connectors are mounted directly on the PCB tracks by soldering them to the sides of the tin plate case. In my station, a mixture of microwave SMA- and SMC-type connectors is used. Do not use BNC types at 23cm or above — you will be wasting your hard-earned cash in connectors that are useless at these frequencies. N-types are acceptable and will work up to 10 GHz. Once the case and connectors are made up, the PCB can be tacked into place and then, once checked correct, seam-soldered along the PCB edges. This provides an excellent RF-tight enclosure and a rigid mount for the PCB. Now the mounting of components can begin.

Surface mount components are actually quite easy to use; again it's simply a matter of technique. They can be handled easily by using a fine-tipped soldering iron and fine-gauge solder. SM components lay flat against the board and not on a vertical edge [see **Fig. 3(a/b)**]. To solder them, arrange the position of the component and then hold in place with a fine-tipped tool. The iron is then tinned and brought onto one end of the component and the PCB. This should then hold the component in place. The iron and solder are then used to solder the opposite end of the component. Finally the first joint is remade using the iron and a little solder. This all sounds complicated, but it takes longer to describe than to actually "do"!

Putting the components on is usually quite a quick process, and generally I find it much easier than using components with long leads.

Most microwave kits need only basic alignment. This is because all the hand work, such as filtering and matching, has been done at the PCB level. This makes building a modern microwave transverter easier than ever.

Uplink amplifiers for Mode L

Although our basic transverter is now producing power, some amplification is still needed to get the transmit power up to a decent level. For most applications, 15-20 watts are sufficient especially when coupled to a reasonable gain 23cm antenna such as a helical or small dish. (See elsewhere in this satellite special edition.)

Producing power on 23cm is as easy as 2m but not as cheap! Fortunately for us, Mitsubishi manufactures a range of amplifier "black bricks" for 23cm. To get 20 watts on 23cm requires two bricks: one to take our 10 mW to 1 watt and then a second brick to take the power to 20 watts. These blocks are quite easy to use, and the only downside is their price!

Kits for 23cm amplifiers (1 watt and 20 watts) are readily available from a number of kit manufacturers, both in ready-made or kit form. This enables

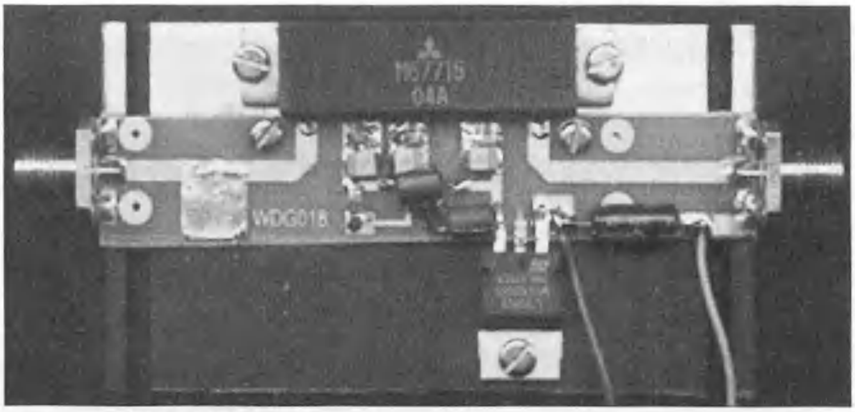

Photo B. G3WDG 1W 23cm PA.

them to be easily integrated into an existing station.

If you decide on these bricks amplifiers you need to make sure you stick to a few ground rules! They need to handled carefully! Make sure you do not exceed the maximum rated voltage, keep them well cooled using a suitable sized heatsink, and use a fan if necessary: A 20 watt module may dissipate as much as 60 watts in heat! And don't overdrive them. If you keep to the rules, then they will perform well and have a long life. Two modules are shown as examples of this type of technology. Again, these are by Charlie G3WDG. I make no apologies for being biased towards his kits. They are well documented and he makes little secret of his kits, which makes them easy for showing how the technology is used. The first module is the G3WDG018 (**Photo B**) 1 watt PA. This is mounted on a small fiberglass PCB. The component count is very small and easy to construct. It will take the 10 mW from the transverter up to 1 watt. The design has an onboard bias supply and a DC switch to disable it during receive periods.

The second amp is the G3WDG017 (**Photo C**), which takes the 1 watt to about 20 watts. The technology is the same as the 1 watt amp, but it will need a substantially larger heatsink.

Connectors and cable

If producing power at 23cm is easy, then losing it in poorly chosen connectors and cable is easier still! Why, after paying plenty of bucks for a PA, do people then choose to lose it all by selecting incorrectly rated connectors to save a few dollars?!

At these frequencies, choosing the right connectors and cable is an important part of your station design. Choose them with the same care as you would any other part of your station.

All antennas, if they are of quality build, will use N-type connectors. Never use BNCs or PL-type plugs and sockets at 23cm. N-types are also good for frequencies up to 10 GHz and so should be your primary choice between antenna and the shack.

Interconnections between the shack should be made using N-types as well, but keep the number of connections to a minimum. Every connector you use eats up a little more power you so preciously generated.

Within equipment the best choice of connectors is the SMx range. These are a range of miniature microwave connectors designed for both miniature flexible cables and the hardline microwave cables.

Whilst on the subject of cables, the interconnection between shack and antenna is vitally important on your L-band uplink. Choose the wrong cable and your precious power will simply heat the cable. Choose a length of Belden hardline or Andrews Heliax and this will ensure that the most power reaches the antenna.

Downconverters for 2.4 GHz

So far we have discussed only how our uplink is designed. To receive the satellite, you will also need a 2.4 GHz receive capability. The very best way to achieve this is to downconvert to either 70cm or 2m.

As with the other items mentioned in this article, there are a variety of converters available on the current market.

Commercially-built converters are available from Down East Microwave, DB6NT, and SSB Electronics, to name a few.

There is also a good range of kits available, and as with the 23cm transverters, these are easily built as long as you can solder proficiently and follow some simple instructions. Charlie G3WDG has just released a new kit for a high-performance but easily built 2.4 GHz downconverter. **Photo D** shows a picture of the completed unit. Similar designs are also available from a number of microwave kit manufacturers.

An alternative option to a kit or commercial unit is to modify an existing commercial unit. Amateurs are always quick to find sources of equipment that can be pressed into service on the amateur bands. A number of commercial SATTV downconverters have been identified as suitable for use on AO-40, and there is plenty of information on

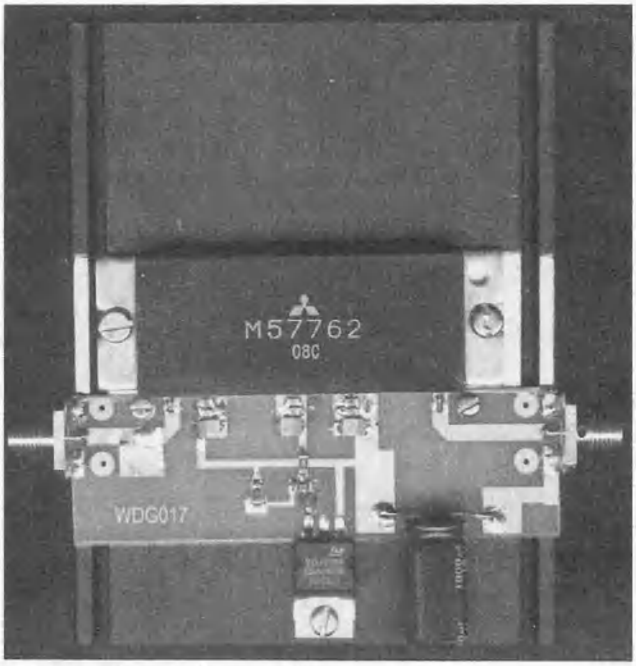

Photo C. G3WDG 18W 23cm PA.

identifying, converting, and tuning them on the Internet.

Above and beyond

AO-40 carries transponders for other microwave bands as well. So far, tests for these units have not been completed, or have given inconsistent results. With the orbital changes to AO-40 now completed, these transponder tests will no doubt continue.

Suffice to say that the techniques for L/S band will give you a great start for the higher bands. Kits for 5.7 and 10 GHz are available, and with some practice at 1.2 and 2.4 GHz, it is possible to construct equipment for the higher bands as well. Modern components are helping in this development, allowing easily built, high-performance kits for the amateur market.

Finale

AO-40 offers amateurs an exciting opportunity. With its large visible footprint and long orbit, the satellite will not need to be chased across the sky. This leads to leisurely and enjoyable QSOs. The use of L and S band means that some will need to learn new skills, but evidence from the AMSAT bulletin board has shown that even people who have never used microwaves before can successfully learn these new skills and adapt easily to this new technology. It's never too late to learn new tricks! It simply takes a little willpower and dedication.

There are now more kits, modules, and commercial equipment available than ever before. There really is no excuse! A station for AO-40 is fairly easy to construct, and hopefully this article has given some insight into what is required and how it connects together.

AO-40 is an exciting satellite that will revolutionize the amateur satellite world. The future is here and now — I hope you come and enjoy it!

Resources

AMSAT Home pages — [http://www.amsat.org]

DB6NT Kits — [http://www.db6nt.com]

Down East Microwave Kits — [http://www.downeastmicrowave.com]

Drake 2880 SATTV Mods — [http://www.g0mrf.freeserve.co.uk]

G3WDG Microwave Kits — [http://www.g3wdg.free-online.co.uk] 73

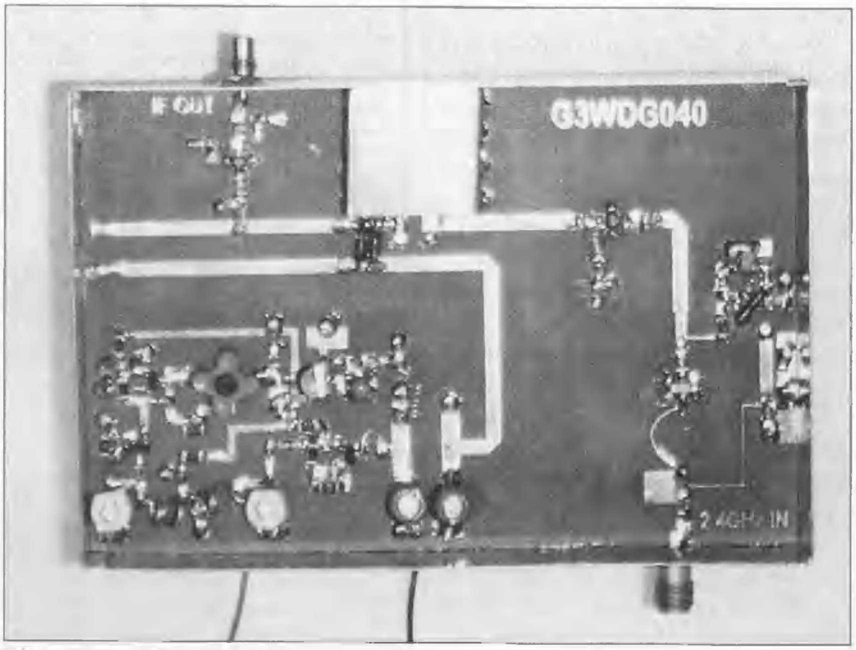

Photo D. 2.4 GHz–144 MHz downconverter.

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United Kingdom

Microwave Antennas for AO-40

The expert speaks.

Over the past few months, AO-40 has really made its mark in the amateur satellite-microwave world. The small period of transponder operation allowed many amateurs to test and tune their equipment and prove their station concepts were correct. This period has also allowed for a period of experimentation and has shown that there are a number of small compact antennas that will work perfectly well via AO-40. This article outlines some of the antennas that have been proven to work via this new satellite and includes some easy-build designs, which can be reproduced at home using simple hand tools and materials easily at hand.

Microwave antennas offer major advantages over their lower-frequency counterparts. Generally they are compact and offer high gain in relation to their size. Most microwave antennas are actually quite simple affairs and do not require major amounts of engineering to be successful. In typical amateur fashion, we have been quick to utilize the ever-growing supply of microwave parts from the telecoms, data, and television industries and put these to use in our microwave stations on the amateur bands. Many of these parts are suitable for use, and I will be showing how to construct very effective microwave antennas from parts easily available at junk sales, swapmeets, and trunk sales. The ground rule for this is to keep your eyes open — it's quite amazing, the bargains you can pick up!

Most microwave antennas come in three main flavors: Slotted or cylinder antennas used for omnidirectional work, yagi antennas, and dish antennas of various types. Some combine to form dishes and feeds, such as the G6LVB SATTV dish and feed I will be describing later. So be prepared for a little variety in life!

Omnidirectional antennas are of little use for serious satellite work, so I will concentrate on yagis and dishes for the purpose of this article.

Yagis and helicals

Yagi antennas for microwave work are generally available up to 2.4 GHz. At these frequencies, yagis offer high gain with compact boom lengths. The trade off is that building antennas at these frequencies requires accuracy, as even small errors in construction can significantly alter the

Photo A. Paul G6UAJ's 144 MHz yagi and 10 GHz 1.2m Landrover dish array.

Photo B. The helical antenna has only one active element which is wound in a spiral fashion. A small reflector is mounted at the rear of the antenna to radiate the RF wave forward and in a circular motion around the shape of the helical.

performance of a design. Designs for antennas at 1.2 and 2.4 GHz are freely available and with a little skill and patience it is possible to construct a good microwave yagi using simple tools and a little patience. A typical yagi array is shown in **Photo A**. This is Paul G6UAJ's 144 MHz yagi and 10 GHz 1.2 M dish array on his Landrover used for rover operating. Yagis can be scaled from HF all the way through to the GHz region if designed with care, and are very versatile.

A downside to the yagi is that it is linearly polarized — that is, it is either horizontal or vertically polarized, dependent on the physical orientation of the antenna's elements. For amateur satellite working, circular polarization is the accepted norm; the linearly polarized yagi will work, but not as effectively as circularly polarized antennas. Luckily for us, the helical antenna fills this design requirement nicely and is easy to build.

The helical antenna (**Photo B**) is very different from its yagi counterparts. It only has one active element, and this is wound in a spiral fashion — hence the term "helical." A small reflector is mounted at the rear of the antenna, and this radiates the RF wave forward and in a circular motion around the shape of the helical. The helix can be wound in either right-hand or left-hand motion, and this gives rise to the same polarization. Building a helical is very easy, and many people already active on AO-40 are using home-made helicals. I will show you how to construct simple helicals later on. The picture shown here is of G6LVB's portable Mode S station using a Sandpiper Communications 23cm helical on the roof of his London flat. His neighbors' 8-foot TVRO dish is also visible.

Dishes

Probably the most popular antenna in the microwave world is the parabolic dish antenna (**Photo C** is HB9DRD adjusting his feedhorn on his small dish). They are very popular, as they offer very high gains in a very small space. For example, a 2-foot, dish at 2.4 GHz can offer as much as 24 dB gain. Gain is only limited by diameter and the mechanical difficulties of handling numerous square feet of dish surface accurately — especially in times of poor weather! The mechanics of the dish are very simple. A concave surface of either metal or composite material covered with a reflecting surface is used to "focus" the incoming parallel RF waves to a point. At the focus of the dish some form of feed is mounted to transfer the received signal to waveguide or coax to be fed to the RF

Photo C. HB9DRD adjusting the feedhorn on his small dish.

Photo D. This dish antenna is a section of a full parabola but does not include the center of the dish.

equipment. The mechanics of small dishes are very simple, and fortunately for us they come in many flavors and types. Prime focus dishes are the typical microwave antenna we see for satellite systems consisting of the full circular dish antenna and a feed at the focal point. Another type that has appeared recently, particularly with the flood of satellite TV, is the offset dish (**Photo D**). This dish antenna is a section of a full parabola but does not include the center of the dish. The feed is mounted on a small arm from the back of the dish, holding it in place at the focal point. There are a number of advantages of this in that the feed does not block the dish, giving better performance, and also does not pick up noise from behind the dish like a full parabolic, leading to a lower noise temperature — this is highly important with today's sensitive microwave equipment.

Feeds

Dish feeds for microwave satellite work can vary in size and shape! Small feeds based on helicals are easy to build and will perform well on both prime focus and offset dishes and are especially popular on the lower microwave bands, I will show you an easily built design that will transform a surplus SATTV dish into a very effective AO-40 antenna. The offset dish can use a similar feed for the lower bands, but feeds can also be built for the higher bands using copper water pipe parts. As we progress, I will show how some of these feeds are designed, and show how easy they are to make using parts easily found at your local hardware store. A quick visit to your local hardware store is like visiting an antenna parts store — all you need to know is what to look for!

Easy-build designs

Building microwave antennas for AO-40 does not require a degree in engineering or science. Designs for the antennas are already available and ready to build. They have been tried and tested and can be reproduced using a few simple hand tools at home. Most of the parts can be obtained from local hardware stores or DIY shops. Armed with a list of material requirements and a tape measure, you will find all you need on a Saturday morning tour of the local DIY establishments. Be warned, however! You will get some strange looks if you tell the shop assistant what you really need that copper pipe for! So just humor them! It's safer that way!

The following designs and projects are not an exhaustive list, nor is it an attempt to be such. I do not claim any of the designs as my own. I have simply

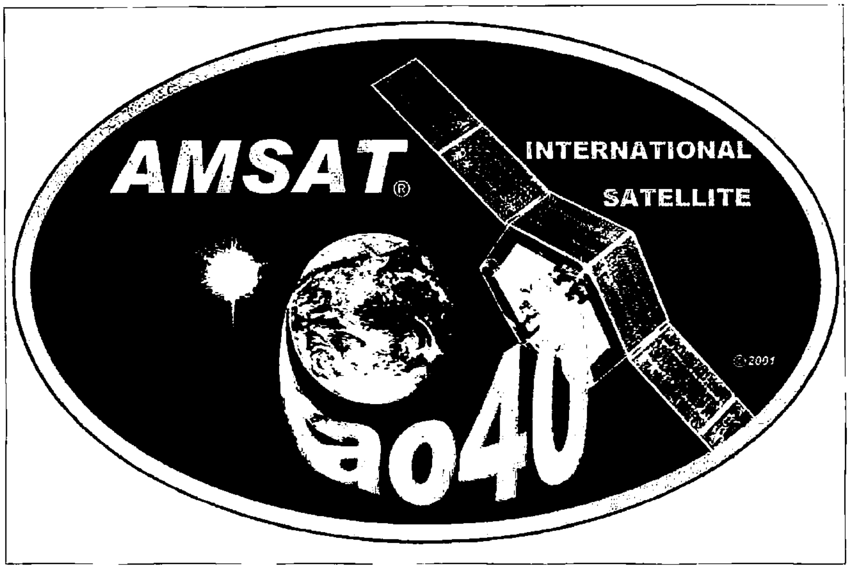

Fig. 1. AMSAT-OSCAR-40 logo.

brought them together to show what kind of designs and technology are in use on AO-40 today. Using simple tools, all should be easy to replicate and work well. The advantage is that they also can be built for a few dollars and save a small fortune over their commercial versions. You will also get some pride out of working AO-40 on an antenna you built yourself. Now there is a talking point on-air or at the local club.

Antennas for 1.2 GHz: a 23cm helical

An easy-to-build 23cm helical is offered using the dimensions in **Fig. 2**. The helical is easy to construct and tune and will give good performance on the Mode L/S uplink at 1269 MHz. The dimensions were calculated using the excellent JAVA applet at [http://vhf.worldsbest.com.au/Helix.htm]. It is a simple matter to manipulate the design to suit the size and gain required and then use these as a basis for a design that you know will work. The 23cm design shown here is a 16 dB gain 16-turn design measuring approximately 3 feet in length. Of course, if you are more ambitious you can build a larger helical, but watch for narrowing beamwidths! The main element can be made from small-bore copper piping or the center of large-diameter coax. It's really a case of what you have easy at hand! The main element can be mounted onto a PVC drainpipe tube or by using small insulated standoff pillars. A boom from a 10mm aluminum square tube can be found in local DIY stores — this makes an excellent boom that will not sag even as a single part. The reflector should be approximately 6 inches square and from either PCB material or aluminum. Again, it's really a case of using what you have on hand! The connector should be an N-type. For more construction information, you should read a description of the antenna constructed by James Miller G3RUH; a copy is available at his Web site [www.jrmiller.demon.co.uk]. The ARRL manual also contains an excellent description of building helicals and should be read in conjunction with the information presented here.

Antennas for 2.4 GHz — a 13cm helical

A design for a similar helical for 2400 MHz is shown in the dimensions in **Fig. 3**. Again it's a simple matter to construct using the same techniques and materials as above. Reflector size is approximately 120 mm square.

Dish feeds

2.4 GHz helical feed — G6LVB helical feed

One of the cheapest ways to become operational on the 2.4 GHz downlink is to use a surplus SATTV dish. In April 1983 during tests of the AO-13 2.4 GHz downlink, James Miller G3RUH constructed a small multiturn helical feed for a prime focus reflector constructed from a lampshade. The original article is still available on G3RUH's Web page and formed the basis of a complementary dish feed that was constructed by Howard Long G6LVB. Howard uses a 60cm offset SATTV dish now widely available in the UK, and a similar design is almost

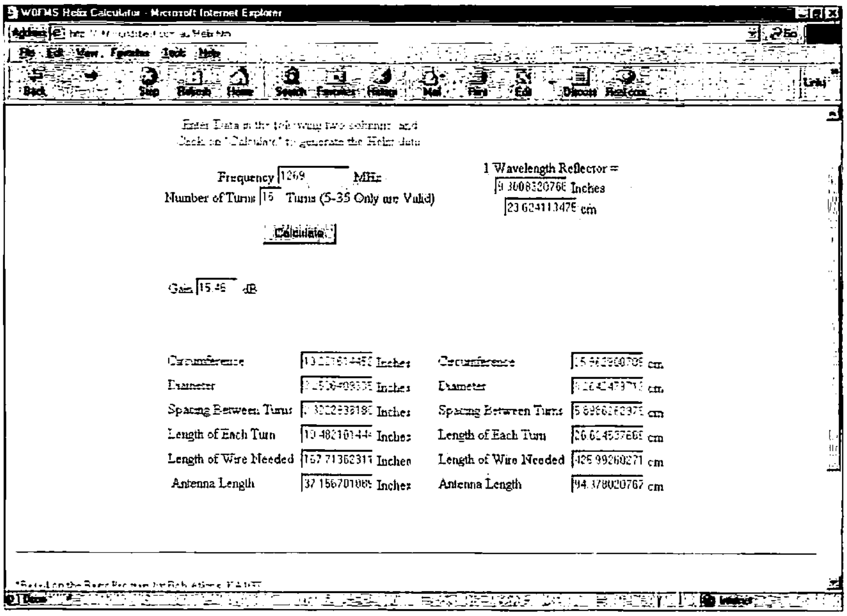

Fig. 2. Use these dimensions to build the 23cm helical.

certainly available in any of the countries where DBS broadcasting has penetrated the domestic market! There are probably hundreds of these antennas just waiting to be liberated from the sides of buildings, yard sales, trunk sales, and hamfests. I acquired three for less than $5 at a trunk sale in one morning alone!

Howard has modified the design slightly by using the original LNB mounting bracket to keep the feed at the right angle to the dish, which is key to best performance. The bracket is modified (with a saw) to make room for the feed reflector. **Photo E** and **Photo F** are pictures of the completed feed. Incidentally, Howard was extremely pleased about how well the dish and feed perform, and if you visit his Web site, take a listen to the audio files of his local beacon. He compares the dish against a 30-turn helical and the dish performs very well. Even after being dropped over the edge of a balcony onto the floor 7 feet below! The dish looks a bit bent but still outperforms the helical by a large margin! Howard claims that it took about 2 hours to build the feed and mount it to the dish! The feed is also very simple to construct and uses 2-1/4 turns of wire or thin tubing wrapped around a 40mm former (socket set bit used in the original!) and a turn pitch of 28mm. This is matched, in Howard's case, by some copper PCB material. The reflector measures approximately 125mm x 125mm and again is made from PCB material. Of course, you can use aluminum and copper shim if you have them on hand. The N-type is mounted using an aluminum spacer to bring the tip of the center level with the reflector. The pictures explain this a little better. Some enterprising person on the AMSAT -BB reflector suggested hacking an SO-239 socket to bits by cutting off the threaded part and removing the inner insulator, as they make nice blanks for this precise job! Never thought I would see an SO-239 being used at 13cm!

This probably represents the cheapest 13cm downlink antenna I can think of, and it is so easy to make that it is no wonder it has become a very popular design, especially as it performs so well and costs so little. Thanks for the time taken to publish the design, Howard!

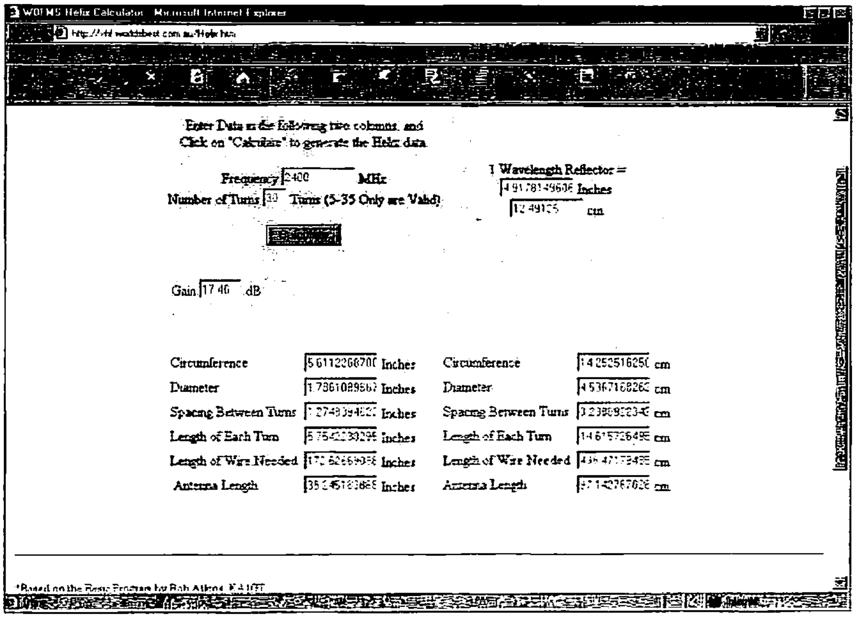

Fig. 3. Dimensions for a 2400 MHz helical.

Further details of the design and testing, and a link to James Miller's original article, can be found on G6LVB's Web site at [http://www.g6lvb.com].

5.7 GHz helical feed — GØMRF helical feed

Dave Bowman GØMRF produced a similar design for the 5.7 GHz band. Although the true status of the C-band system is not yet fully determined, I thought that I would make this satellite special complete by offering some useful designs so that you can at least see that designs for the higher bands are just as easy to complete.

The dish feed consists of a small 4-turn helical wound using 1.6mm-diameter enameled copper wire, with a diameter of 17mm and a turn pitch of 12mm. The helical is mounted to a diecast box of 50 x 50mm that acts as the reflector. At these frequencies you can use an N-type, but for size's sake David used an SMA connector. Again, pictures speak a thousand words, so **Photo G** shows the completed feed. The feed is fairly simple to construct and works well as long as constructed exactly as shown.

For outdoor purposes, a small "radome" or suitable enclosure will need to be completed. This will prevent corrosion between the matching section and the diecast box, and the detuning of your hard work by bugs, water, and other undesirables!

Broadband satellite feed

An alternative to feed a dish is a linear feed. This is not a major disadvantage, as the angle between the antenna on the satellite and an earthbound antenna will change. Subsequently, the potential 3 dB loss in polarization difference could be considerably lower.

The feed shown here is simplicity

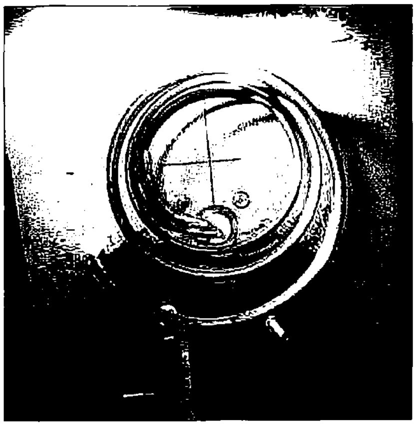

***Photo E.** Howard used the original LNB mounting bracket to keep the feed at the right angle to the dish.*

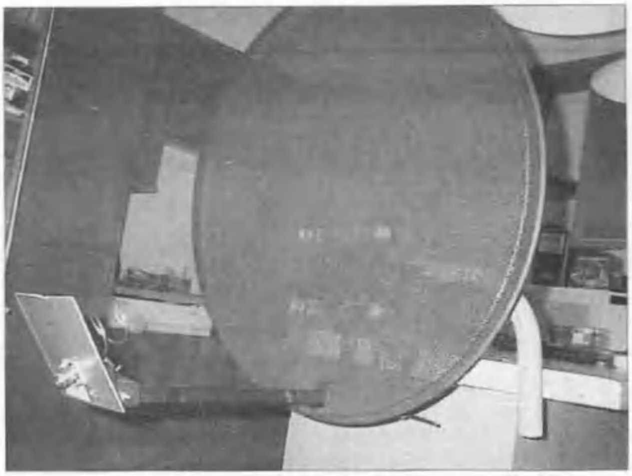

Photo F. The bracket is modified to make room for the feed reflector.

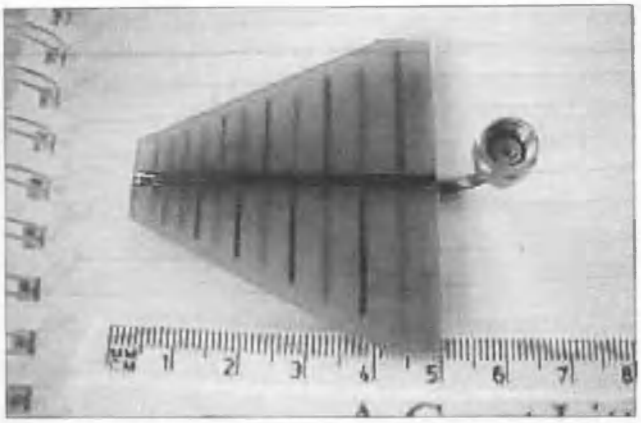

Photo H. Kent Britain WA5VJB designed this very simple feed. It is etched on a piece of double-sided PCB material and covers a frequency range of 2.1–6 GHz.

itself! Designed by Kent Britain WA5VJB, the feed is etched on a piece of double-sided PCB material and covers a frequency range of 2.1–6 GHz (**Photo H**). This means it could be quite easily used on the S-band downlink or C-band uplink. A ready-made PCB is available in the U.S. and U.K. for the feed. It simply needs a small length of semirigid cable and an SMA plug soldered to the feed. There is one slight disadvantage in a broadband feed, in that there is a slight loss in efficiency due to the feed characteristics not being constant across the design range. However, in terms of simplicity, this far outweighs any minor change in design characteristics. You will probably not even notice at the strength you will receive AO-40!

10 GHz offset dish feed — G3PHO dual-mode feedhorn

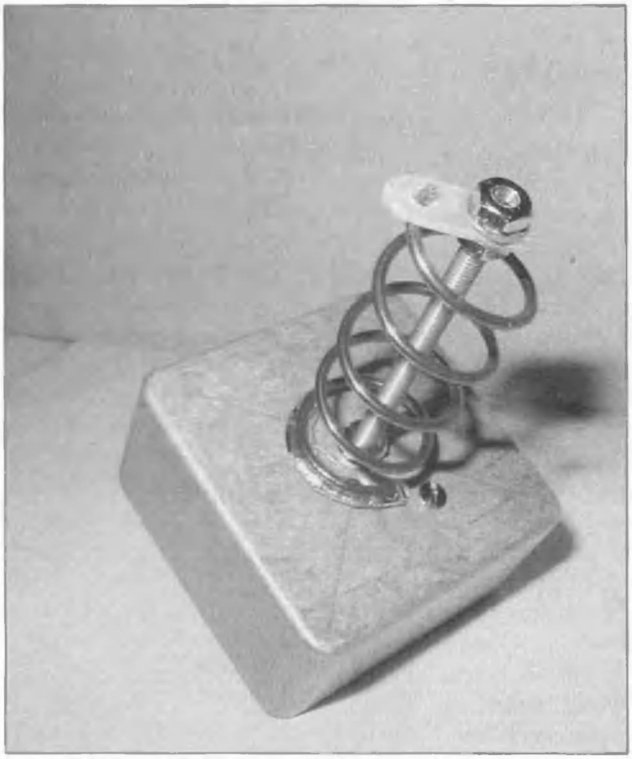

Photo G. This dish feed consists of a small 4-turn helical wound using 1.6mm diameter enameled copper wire, with a diameter of 17mm and a turn pitch of 12mm.

For feeding a 60 or 80cm offset dish at 10 GHz, you could do a lot worse than construct an offset dual-mode feed as shown in this example by Peter Day G3PHO. Peter has shown that an excellent feed can be constructed using copper water pipe fittings available from your local hardware or DIY store. The design was originally shown by W2IMU in two articles in the *Microwave Update* 1991 edition. The design is suitable for offset dishes of 0.5–0.6 FD size and produces an excellent symmetrical radiation pattern in both E and H planes. This design is especially suited to offset dishes, illuminates the dish correctly, and does not pick up noise from behind the dish.

The design is made from a 22mm to 42mm coupler and a straight 42mm coupler which is cut down in length to 47mm. The end of the 22mm–42mm coupler is mounted to 22mm copper water pipe and can then be mounted to a round to square waveguide coupler and WG16 waveguide flange. Or, as an alternative, a 22mm round waveguide-to-SMA adapter can be utilized.

As with the other designs, here are some photos to describe the feed visually (**Figs. 4** and **5**).

The feed is mounted using the existing dish mount bracket.

Designing antennas and feeds

There is a variety of design and build information available in printed and electronic form. Most of these will assist you in designing and building antennas and feeds for almost any amateur microwave location. But with so much of the groundwork and testing done in the designs presented here, there is little point in a newcomer, struggling through the complicated design issues, trying to get a working station together for AO-40.

In printed form, the ARRL and RSGB publish a number of microwave manuals that are extremely useful. They contain tried and tested designs from a number of authors over the

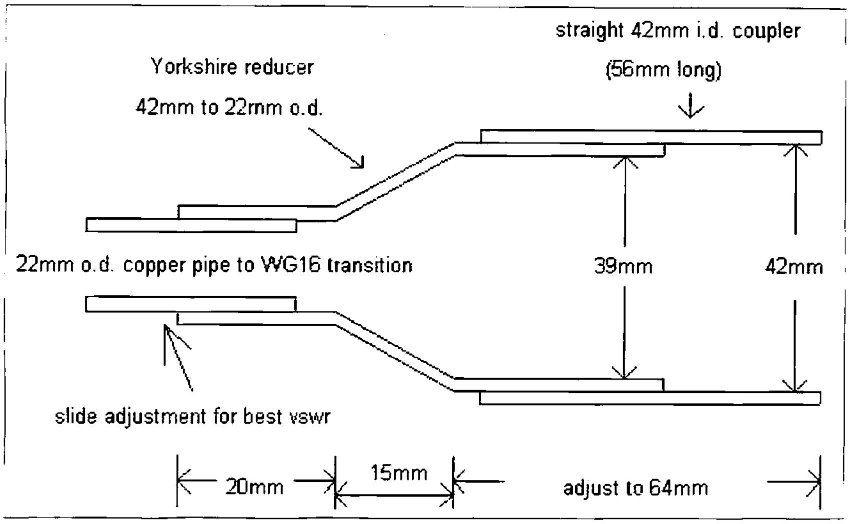

Fig. 4. Actual dual-mode horn assembly dimensions using a 60cm Amstrad offset-fed satellite dish.

years. The *ARRL Handbook* is another excellent resource, and this has also contained some very useful designs over the past few years. The current edition contains some nice designs for both 70cm and 23cm uplink bands.

The best source of antenna design information has to come from the Internet, and I make no apologies for repeatedly referring to it. The net has a great deal of live and up-to-date information available, and many sources of information on antennas and feeds that simply never makes it to print. Many amateurs publish small items on their Web site, such as G6LVB's dish and feed design here, that are of great interest but would never make it to print in a full-blown article in a magazine. There is also some highly useful information on W1GHZ's Web site: [http://www.w1ghz.cx]. This includes a very useful on-line antenna handbook for microwave antenna construction. This shows a number of useful designs and background design information, as well as antenna polar patterns and information on commercial feeds available. This resource is an invaluable site and veritable treasure trove from the experimenter. The site is also rich in other sources of design and component information for antennas, and is a must-see.

Software

Of course, apart from written and printed information, these sites also contain a variety of software packages. W1GHZ's site contains a number of software packages specifically aimed at the microwave antenna experimenter. HDL_ANT is a particularly useful package for antenna calculations, and will calculate offset and prime focus dish feed and gain calculations. FEEDPATT is a similar package that is specifically designed to calculate design parameters for microwave feeds. Again, another very useful package!

There are plenty of other resources on the net, and all are well worth looking for. An evening spent browsing will reveal a range of packages and information resources to help you along.

Conclusion

Amateur microwave antennas and feeds are not difficult to construct and are easily built using small hand tools and readily available parts obtainable from your local DIY or hardware store. The designs shown in this article are tried and tested and will perform as intended as long as you build them in the way the designer intended, using the same size and types of materials shown. Just remember that at these frequencies small errors in measurements equal a large change in design due to the small wavelengths involved. Build the design as intended and using the measurements shown, and you will be successful every time. However, you don't need to become too exact and measure to fractions of a millimeter. You *can* get *too* accurate! Use a little common sense. Generally measurements to the nearest millimeter are quite sufficient.

Many of these designs will also be found replicated in the commercial world. Feeds for the higher bands are especially easy to find and should not be written off. The greatest fun at microwave is trying something new, and with AO-40 you have a flying signal generator to test your antennas on.

Have fun building your designs. It will almost certainly become the talking point of your contacts and give great pleasure to know that you have saved yourself hundreds of dollars and

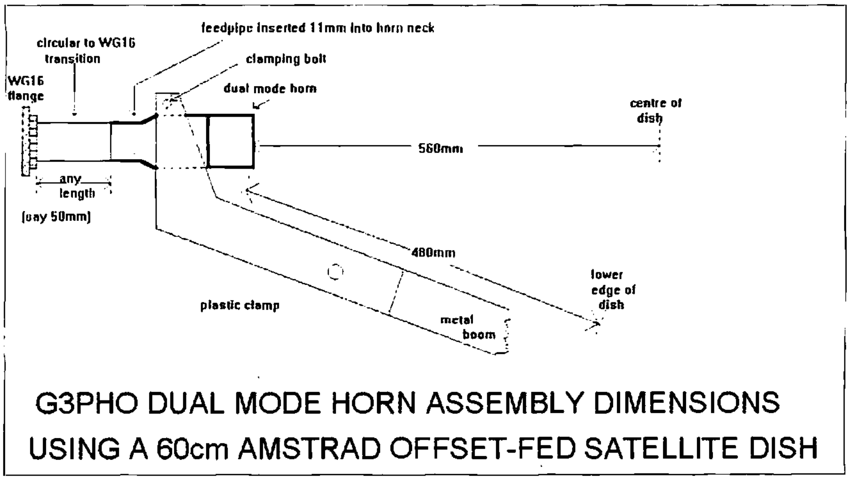

Fig. 5. Dual-mode horn mounting configuration.

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Modifying the TranSystem 3733 for Mode S

Get in on the fun!

To paraphrase Mark Twain, the demise of AO-40 has been greatly exaggerated! Many of us are having a ball on mode S with low-cost downconverters. Here is how you can get in on the fun using the TranSystem 3733 downconverter.

The TranSystem 3733 shown in **Photo A** is a modern marvel of electronics. It was designed for use in "wireless cable TV" systems. It takes the signal we want from 2400 MHz and converts it to VHF where we can use it. With very little modification it can be turned into a high-performance amateur downconverter. It comes in a weatherproof enclosure and features an integrated antenna, eliminating feedline losses and allowing the use of low cost cable such as RG-6.

The first thing you need to do is acquire a downconverter and power supply. A little snooping on the Internet should do the trick. They are relatively common items on places like eBay. Bob Seydler K5GNA [k5gna@aol.com] is selling the units as well as many other parts and accessories that can be used for modification. You are not going to need any exotic test equipment or strange tools to get on the air with this unit.

A special note on the power supply: The downconverter was designed to be powered by a DC voltage placed on the coax feeding it. This prevents the need for running additional wires for power. Typically, a "power inserter" is placed between the radio and the downconverter. This inserter will send power to the downconverter and block the DC from getting to the radio. A "wall wart" usually powers the inserter. The downconverter needs at least 15 volts DC to operate; this is due to the 12 volt regulator inside the unit. The need for this high of a voltage will probably prevent you from powering the downconverter with your radio's preamp power supply.

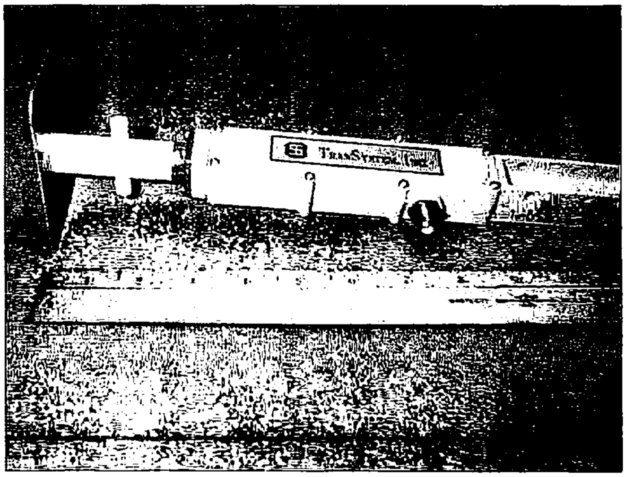

Photo A. *TranSystem 3733 downconverter.*

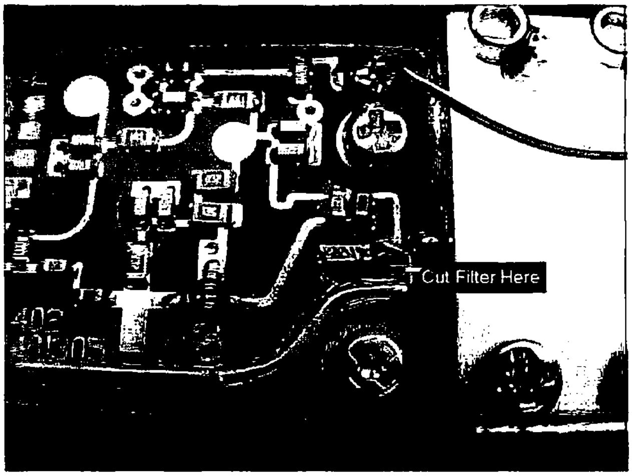

Photo B. *Stub cut location. [Photo by Mark Hammond N8MH]*

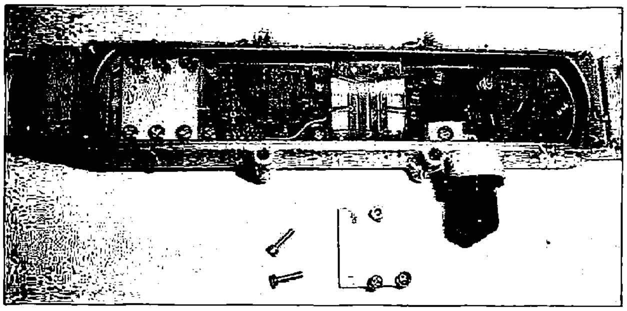

Photo C. Second stage filter (cover removed). [Photo K5GNA]

Now here is the one modification required to get on the air. The unit was designed to work both above and below the 2400 MHz amateur band. In fact, it has a notch filter on the amateur frequencies. We need to disable this notch filter. Fortunately, this is rather easy to do! The notch filter is a piece of small-diameter coax. Remove the cover on the side that says "TranSystem" in large print. With the integrated dipole to the left, between the two square aluminum plates (we'll talk about them later) is the small piece of coax. Snip the coax right where the center conductor ties into the circuit as shown in **Photo B.**

If your radio will tune SSB at 122 MHz, this is all you need to do to get on the air! I worked quite a few stations on AO-40 using my 3373 having only this mod. The guys with the fancy test gear say this yields a noise figure of less than 4 dB.

If you want better performance (and who doesn't?), there is another mod that is fairly easy to do and yields a noise figure of about 1.4 dB. In this mod, we will replace the second stage filter with a bandpass filter. The original design was for use above and below the ham band. The notch (that we just removed) provided image rejection in the original design. We could add another notch filter tuned for below 2400 MHz. but it is easier to add a bandpass filter replacing the second stage filter. The filter of choice is the Murata DFC22R44P084BHD — its passband is from 2400 to 2480 MHz. I purchased the filter and PC Board from K5GNA.

Start by removing the second-stage filter. It is located under the metal plate near the middle of the unit. It is shown without the cover in **Photo C**. Be sure to save the pieces, because we are going to need them. Install the Murata filter on the circuit board (skip this step if yours was already mounted). I set it on a piece of cardboard and held it in place with a couple of straight pins as shown in **Photo D**.

Next, cut the "fingers" off the old filter, and use the strip with the holes in it as a washer on the top of the filter (where the cap head screws go). The new filter is shown installed in **Photo E**. Take a couple of small pieces of #20–#22 wire and connect the new filter in the circuit. This is also visible in **Photo E.**

At this point, you have a high performance downconverter that takes a 2400 MHz signal and outputs it at 122 MHz. This is the configuration I use my downconverter in. I like using it at 122 MHz because if I accidentally key my radio instead of sending RF into the converter my rig just says error. If your radio doesn't work at 122 MHz, you will want to replace the crystal. The crystal is on the other side of the unit and it is socketed. It is a rather simple thing to replace. And the crystal is available from Jan, ICM, K5GNA, and just about any other crystal supplier. Very close to the crystal is a small variable capacitor that can be used to fine-tune the oscillator frequency. I have never worried that much about fine-tuning the frequency. If I can tune in the beacon and other stations to make QSOs,

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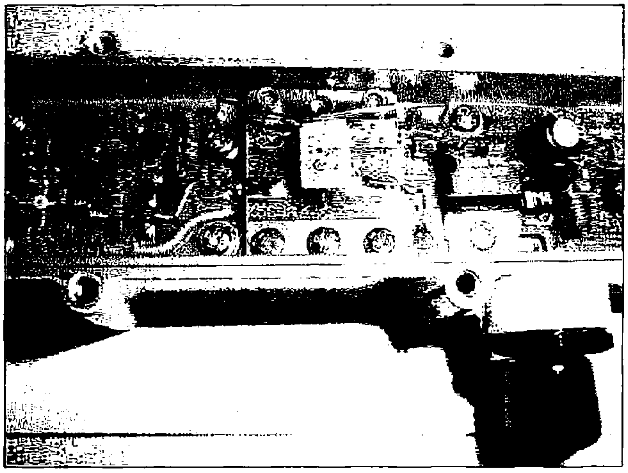

Photo E. New filter installed. [Photo K5GNA]

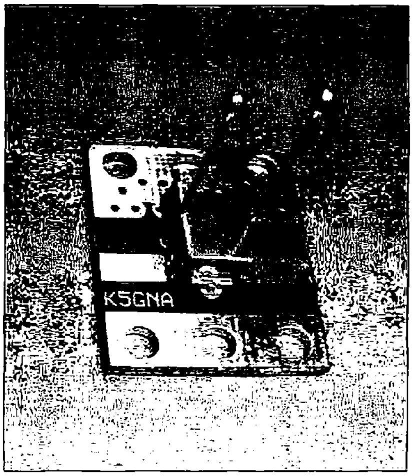

Photo D. Bandpass Filter ready to be soldered. [Photo K5GNA]

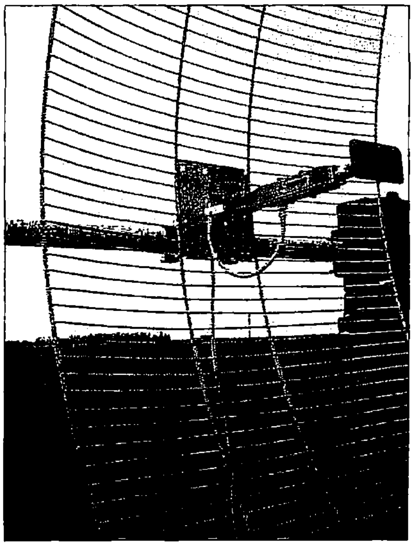

Photo F. Downconverter and integrated antenna installed. [Photo KAØYOS]

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Build the FODTrack

How about a low-cost tracking interface?

Here is a low-cost solution to fulfill your automated satellite tracking needs. Manfred Mornhinweg XQ2FOD has made this free for noncommercial use. He says, "If you want to reward me somehow, write a piece of useful software and put it in the public domain!" I have built several of the FODTrack interfaces for less than $35 each using all new parts. Here is what I have found.

The FODTrack controller connects to the parallel port (the printer port) on your computer, and plugs directly into the back of the controller for the Yaesu G-5400/5500/5600 rotators. If you are using another rotator or combination of rotators you will need to do some modifications. All of my testing has been done with a Yaesu G-5400B rotator package.

I started by downloading the entire FODTrack package from the PC Software section of the AMSAT Web site. As of this writing the current version is 2.6. The package contains some pretty good documentation as well as the schematic and art work for the circuit board. FODTrack is much more than just a tracking interface, but I am limiting my discussion to that portion.

Let's move to the computer end. The parallel port — your new computer may not have one! If it doesn't, you can buy PCI or ISA cards that will add parallel port(s) to your system. You may want to consider pulling that old 486 out of the closet and using it exclusively for tracking. If you only have one parallel port, maybe it is time to buy a new USB printer and free the parallel port up for the FODTrack. Maybe you just need a parallel port switch and can select between the FODTrack and the printer. Anyway, you need a parallel port to make this work! Personal experience recommends that you do not switch from printer to FODTrack or FODTrack to printer with the computer on. Let's just say this is why I know the PCI parallel port cards work!

Fig. 1 is the schematic. It is not that

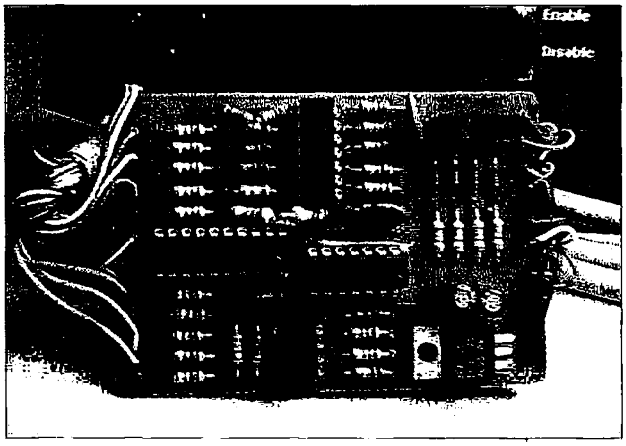

***Photo A.** Here is a view of the completed circuit board. My junk box came in handy for this.*

***Photo B.** Front view of the completed controller.*

complex of a circuit, and should not be too difficult to wire point-to-point. I chose to etch my own board from the included artwork file. I just printed it out on a laser printer (actually printed it twice on the same sheet of paper for a double coating of toner), and ironed it onto some circuit board material. If you do this, be sure to touch up any light or missing spots with a permanent marker. I did the same thing for the parts overlay and ironed it on after I etched the board. Radio Shack's circuit board experimenter's kit has enough materials to do three of these boards. I have since learned that the boards are available from FAR Circuits [http://www.cl.ais.net/farcir/].

Unlike many projects, this one does not require any unobtainium. All of the parts except the circuit board are available from Digi-Key at [http://www.digikey.com/]. See **Table 1**.

Photo A shows my completed circuit board. Use standard building techniques. Solder in the sockets, but don't put the chips in the sockets until you are ready to go. I have a couple of construction notes to share. I must confess I raided my junk box for a couple of the parts shown in the picture. If you use the parts list above you won't have any resistors wired in series for equivalent values. I could not find the BC546 transistors shown in the schematic. It doesn't do anything other than switch so I substituted a good old 2N3904; just about any NPN transistor would do. The 2N3904 has worked well. The legs on the 2N3904 are in a different order than the BC546. They wind up going in backwards from what the parts overlay shows. Just make sure your base, collector, and emitter connections are the same as in the schematic and you will be fine. It is cheaper and easier to buy a manufactured parallel cable (make sure it is long enough) and cut it and connect it to the circuit board. Building a cable from the ground up is more heartache than it is worth. Just use your ohmmeter to determine which wire connects to which pin. For added show, I placed an LED in series with the output (collector) of the up, down, left, and right transistors. This way, I get an indication when the controller is moving the antennas.

Photo B shows my completed controller. My up, down, left, and right LEDs are on the left-hand side. You may have to do a tiny bit of filing or trimming on the circuit board to have it fit in the enclosure I have chosen. Be sure not to damage the circuit board traces if you do this. Since the enclosure is black, I printed white text on a black background from the Paint program onto the labels. I think it looks nice!

Follow the included instructions for calibration and setup and you should be set! There is a driver available to use the FODTrack interface with WISP. There may be other drivers as well. I use the FODTrack program that comes with the package. It is easy to

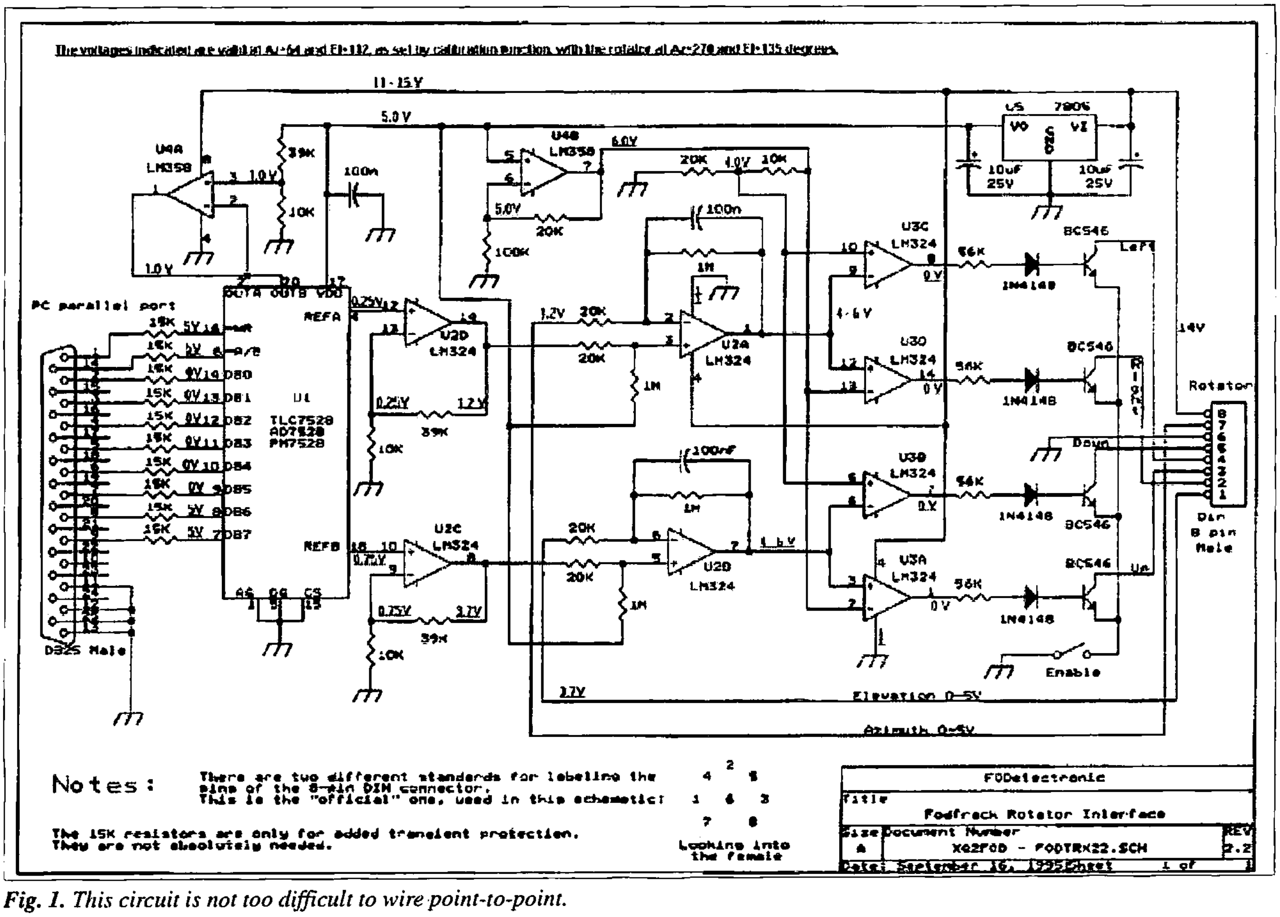

Fig. 1. This circuit is not too difficult to wire point-to-point.

Qty.	Digi-Key P/N (add -ND)	Description
Resistors (Qty. in 5-packs)		
1	10KQBK	10k
2	15KQBK	15k
2	20KQBK	20k
1	39KQBK	39k
1	56KQBK	56k
1	100KQBK	100k
1	1.0MQBK	1 meg
Capacitors		
3	P4201	0.1 µF ceramic (100 nF)
2	P5148	10 µF electrolytic
ICs		
1	LM340T-5.0	LM7805 Voltage regulator
2	296-1392-5	LM324 Op Amp
1	296-1395-5	LM358 Op Amp
1	296-1871-5	7528 Analog-to-Digital converter
Semiconductors		
4	1N4148MSCT	1N4148 diodes
4	2N3904	2N3904 transistors
Miscellaneous		
1	SW102	Switch
1	AE7220	20-pin IC socket
1	AE7208	8-pin IC socket
2	AE7214	14-pin IC socket
1	AE1112	Parallel cable (get the length you need)
1	275-1005	8-pin male DIN connector (plug in to rotor box)
1	HM104	Box
1	PCB	Not from Digi-Key
Additional wire, tools, etc.		

Table 1. Parts list.

use and free! I also use FODTrack for Doppler compensation, but that is another story.

Hope to hear you on the birds! ■

Gerald R. Brown K5OE
Houston TX

What IS an EasySat, Anyway?

Now you know.

With all the press about the latest and greatest satellite, AO-40, many people forget that we have a fleet of lesser, yet perfectly workable and fun, Low Earth Orbit (LEO) "EasySats."

There have been numerous articles — for decades — extolling the ease of getting on the "EasySats." Why then don't more amateurs try them? They truly can be "easy," when you know four critical things: (1) what frequencies and modes to use; (2) how to make a QSO; (3) when they are overhead; and (4) where they are. Now that seems simple enough, but it takes a little work and it takes a little practice — but not too much. This article supplies you with some of the basics, and the Sources at the end provides some excellent references, both in print and via the Internet, for finding operating frequencies and practical tips for successful operation.

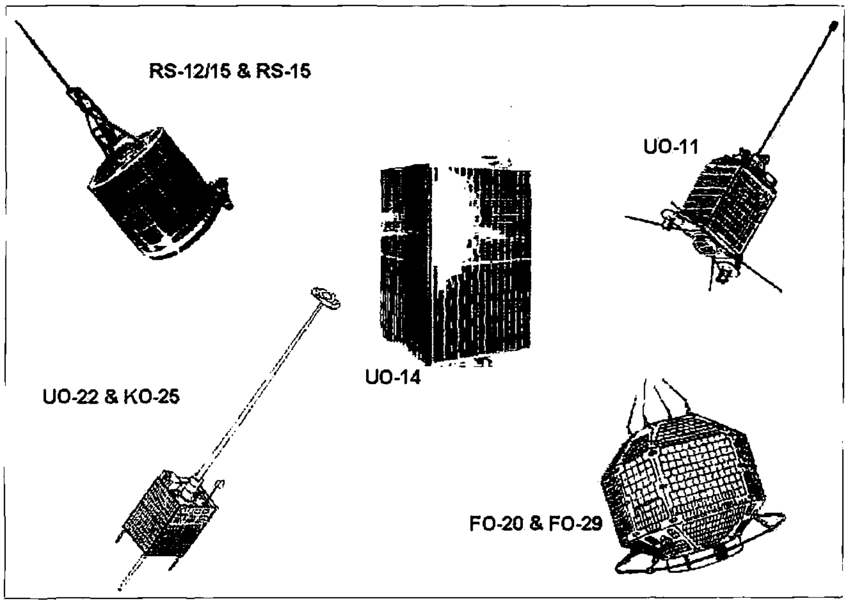

Fig. 1. Some of the current "fleet" of amateur satellites you can work with simple equipment and antennas (not to scale).

What and how

First, let's agree on what an "EasySat" is and how to work one. Generally, an "EasySat" is defined as one an amateur radio operator can work with equipment already owned. After all, what could be easier than just learning a new mode with the equipment you are already familiar with and have in front of you? For example, my first satellite QSO was made using my HF radio in "split" mode — just like working DX on 40 meters. It was on RS-12, using 15 meters for the uplink and 10 meters for the downlink. Unfortunately, the days of HF satellites are quickly drawing to an end, as most of the satellite activity is now on VHF — and above — frequencies. Even if all you have is a 2-meter FM radio, you still have the ability to work an EasySat: the International Space Station (ISS). The ISS has both packet and voice capabilities on 2 meters. Oh, and APRS, too!

The next class of satellites easily workable with typical shack hardware are LEOs operating with 2-meter uplinks and 70cm downlinks, both FM. Currently the "fleet" consists of two "birds": AO-27 and UO-14. Many

Fig. 2. The author's QSL card from a 2-meter QSO with Susan Helms (NA1SS) aboard the International Space Station earlier this year.

people work these satellites with HT's and mobile FM radios — even while driving. These are without a doubt the most easily accessible and popular satellites today. Many operators take an HT with them when they go fishing or camping, even boating or on a cruise, and give other operators the chance to work rare grid squares. VUCC is alive and well on the satellites. One important point: UO-14 is much easier to hear than AO-27, and thus can be extremely crowded (competitive!) at times, so weekday morning passes are highly recommended for beginners. Listening first for a few passes is also recommended to get the feel for the action — it can be fast and furious. Make your calls by "tail-ending" another QSO, and make it fast.

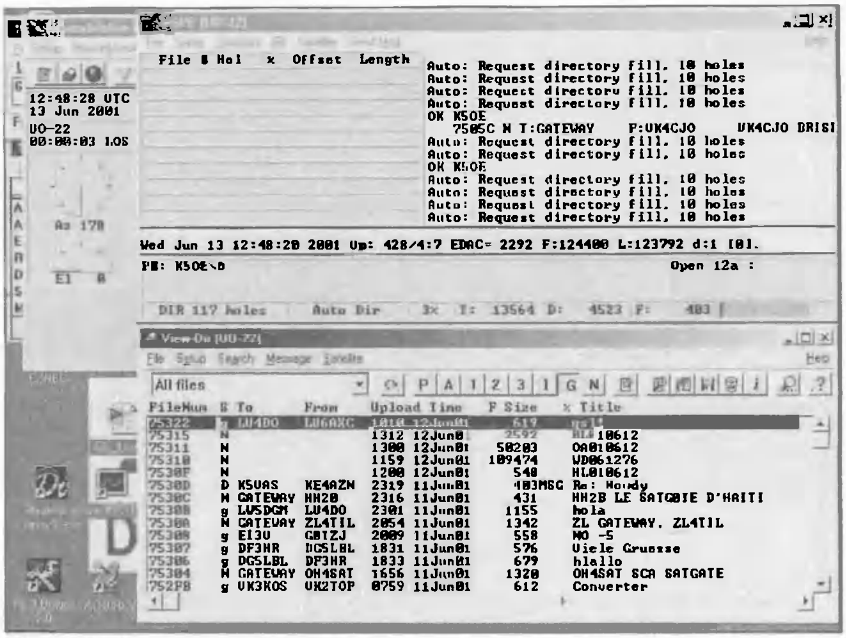

Fig. 3. UO-22 operation using WISP PacSat software.

If you have V/UHF FM capability and have a digital bent, then maybe packet satellites will interest you. There are currently two packet satellites (pacsats) operating at 9600 baud that are relatively easy to work: UO-22 and KO-25. The only difference from terrestrial packet, other than being at 9600 baud and not 1200 baud, is the special pacsat software required. Of course, a 9600 baud TNC (or PC soundcard TNC program) is required. The PB (DOS) or WISP (Windows PC) software available from AMSAT handles all the software routines automatically, from tracking the satellites to downloading messages, and connecting to the satellite for upload of any messages, pictures, whatever. Full, unattended station operation is possible, and you can try the software out for free. Most modern dual-band

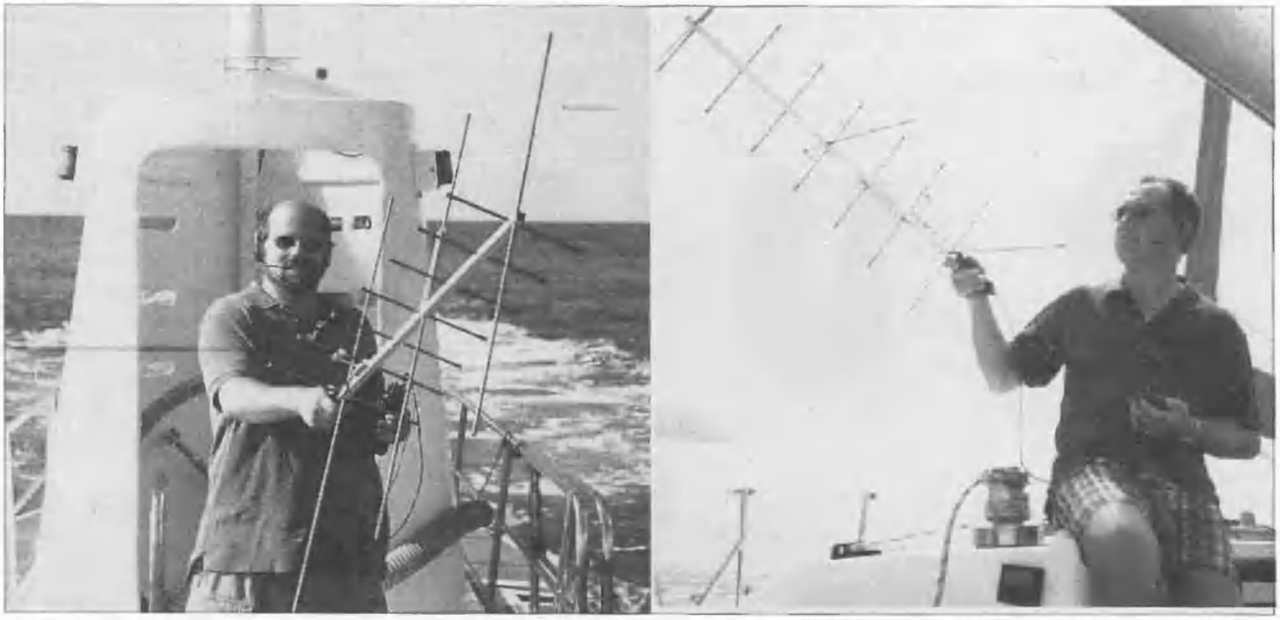

Photo A. Using an HT and an Arrow Antenna to work the FM EasySats, ZF1DH (VA3DH) is on a submarine deck in the Caribbean and G3VZV is on a sailboat in the Mediterranean. I told you it was fun!

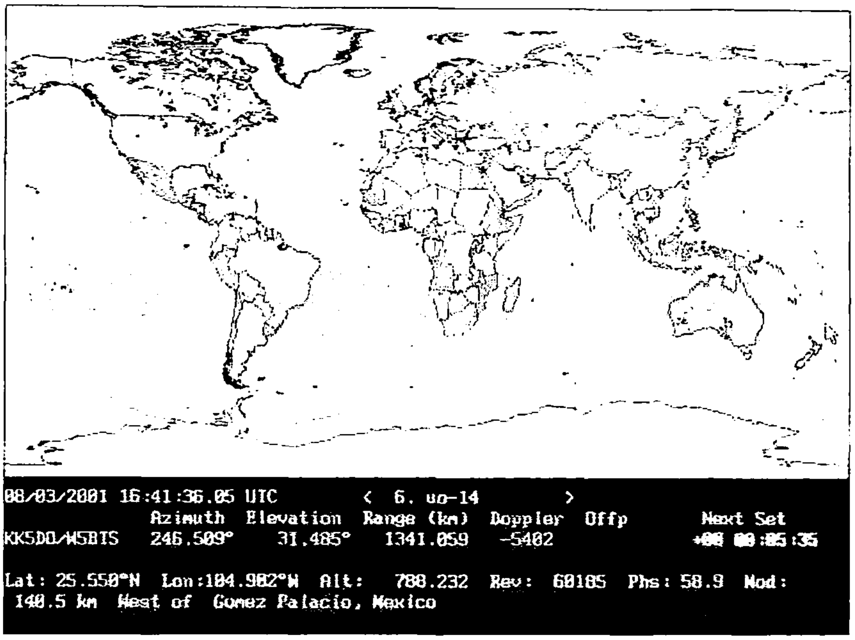

Fig. 4. Tracking satellite passes using AMSAT's InstantTrack.

mobile radios have full 9600 baud capability built-in. Also see the Sources for references to information about some of the older 1200 baud digital satellites such as UO-11 and the ASTARS program.

The next-easiest satellite class are those that have 2-meter SSB/CW uplink and 10-meter downlink: RS-12/13 and RS-15. If you have a radio with 2-meter SSB/CW capability, this mode is still easily workable in "split" fashion as I noted above. It helps to be able to hear your downlink, but it is not critical at these frequencies. RS-12 is quite easy to hear and work. Typical stations use a dipole on 10 meters to receive the signals and a 2-meter ground plane or J-pole antenna with 10–50 W uplink power. Late-model mobile radios like the FT-100, FT-817, and IC-706 are often heard on this satellite. RS-12 can

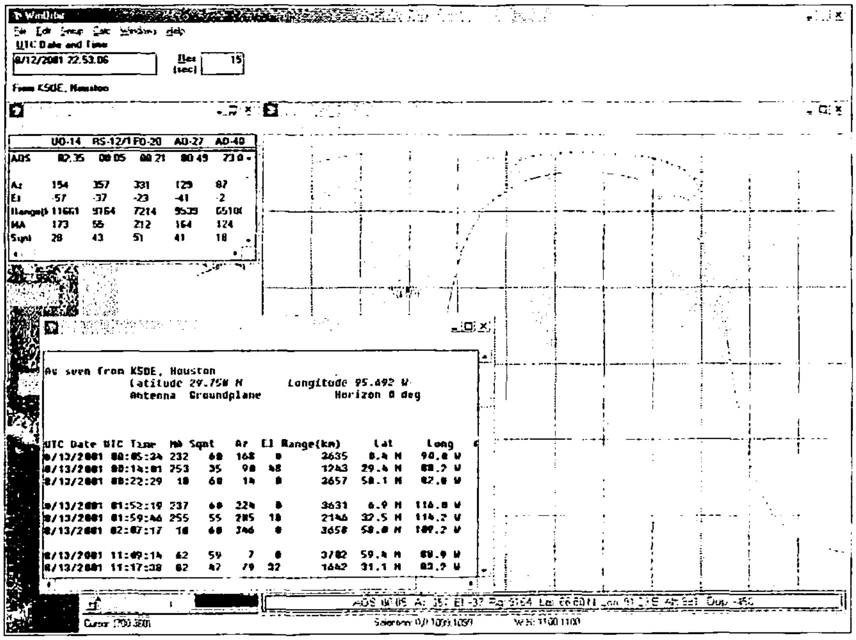

Fig. 5. Plotting future satellite passes using WinOrbit.

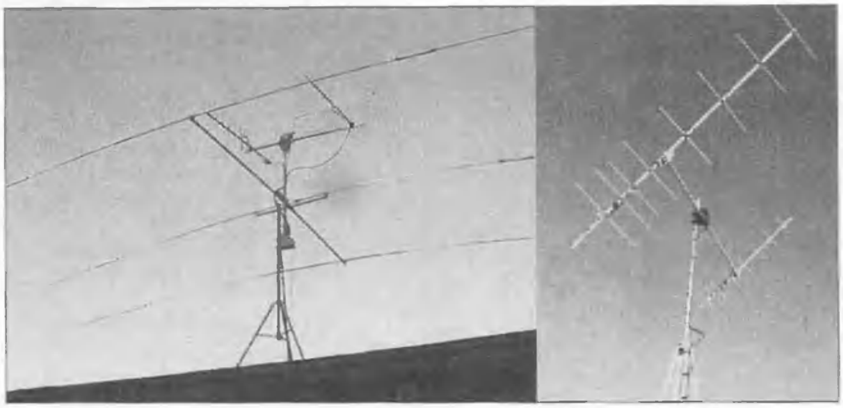

Photo B. V/UHF satellite antennas on the rooftops at KO4MA and KD9KC.

operate with other uplink/downlink combinations, including multiple uplinks or multiple downlinks at times. When this solar cycle wanes, perhaps the controllers will return it to simultaneous 2-meter and 15-meter uplinks. In that mode, CW was very popular. RS-15 is a difficult satellite to work, requiring significant uplink power and a very good receive system — thus is lightly used.

Finally, the last class of EasySat LEO, the SSB/CW birds FO-20 and FO-29. These really are the ultimate LEOs, but are really more like "IntermediateSats" than EasySats. Both of these satellites also use 2 meters for the uplink and 70cm for the downlink, but full-duplex operation is generally required due to the high Doppler shift of the signals. These satellites have excellent audio characteristics and have 100-kHz-wide passbands — allowing many simultaneous conversations for 10 to 15 minutes at a time. Roundtable discussions with 3, 4, or 5 operators are not uncommon. Radios such as the FT-726/736/847, TS-790/2000, IC-820H/821H/910H, and older pairs such as the IC-271/471 are typically used along with beam antennas controllable in both azimuth and elevation. Antennas for these satellites range from simple omnidirectional antennas like eggbeaters to the big "OSCAR-class" setups.

When and where

Now that you have an understanding (and lots of references for further information) of what satellites might be easy to work and how to work them, let's move on to the other two critical items: when and where to find them. Fortunately, both of these questions can be answered with the convenient computer-based tracking tools available today. Modern personal computers handle with ease the calculations necessary to predict and plot the orbits of the amateur satellites. Software is available for DOS, Windows, Mac, CE, Linux, etc. I often use a Palm PDA (personal digital assistant) when mobile/portable to track the satellites. Real-time tracking tools are even available as Web-enabled screens over the Internet.

Maybe "easy" has always been a stretch, as it is a lot of new information to the uninitiated. But, it can be handled a little at a time and soon becomes second nature. I encourage you to read further, ask questions at a local club meeting, or see if you can find a satellite "Elmer" to help you learn and to join in on the fun.

Sources

In Print:

The ARRL Handbook For Radio Amateurs, The American Radio Relay League

The Radio Amateur's Satellite Handbook, M. Davidoff K2UBC (available from both AMSAT & ARRL)

On the Web:

The first place to stop, AMSAT-NA: [http://www.amsat.org/]

FAQ and introductory articles (be sure to read *Working The Easy Sats* by WA4YMZ): [http://www.amsat.org/amsat/intro/faqs.html]

Software: [http://www.amsat.org/amsat/ftpsoft.html]

Elmers: [http://www.amsat.org/amsat/fieldops/AAC.html]

Nets: [http://www.amsat.org/amsat/activity.html]

The ISS APRS map of stations (cool!): [http://www.ariss.net/]

Home-brew handheld antenna: [http://xe1mex.gq.nu/]

Home-brew antennas: [http://members.aol.com/k5oe]

Mobile operation: [http://members.aol.com/dquagliana/beginner.html]

Portable operation: [http://www.qsl.net/wb8crj/]

APRS Satellite Tracking and Reporting System: [http://web.usna.navy.mil/~bruninga/astars.html]

Amateur radio on the ISS: [http://www.rac.ca/ariss.htm]

RS-12/13 FAQ: [http://www.qsl.net/ac5dk/rs1213/rs1213.html]

AO-27: [http://www.amsat.org/amsat/sats/n7hpr/ao27.html]

UO-14: [http://www.ee.surrey.ac.uk/CSER/UOSAT/missions/uosat3.html]

UO-11 News from G3CWV: [http://www.users.zetnet.co.uk/clivew/index.htm]

UO-22: [http://www.amsat.org/amsat/sats/n7hpr/uo22_kd2.html]

On-line satellite tracking: [http://liftoff.msfc.nasa.gov/RealTime/JTrack/]

On-line satellite tracking: [http://www.heavens-above.com/]

On the Air:

The AMSAT HF Net: Sunday 1900 UTC, 14.282 MHz.

The Houston AMSAT Net: Tuesday 2000 local time (0200 UTC Wed.), 145.190 MHz (PL 123.0); also broadcast live via the Internet at [www.amsatnet.com]. 73

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Annapolis MD 21402

The PCSat APRS Satellite

More fun on the horizon ...

If all went well, in September 2001, the amateur satellite community gained another amateur satellite. Named by the students as PCSat, for Prototype Communications Satellite, this satellite should offer handheld communications capability to amateur radio travelers anywhere worldwide.

The downlink from PCSat will be fed into the Internet for live worldwide distribution of data. A unique feature of PCSat is that it contains no computer. The entire telemetry and command/control system was built from an off-the-shelf Kantronics PK-9612Plus TNC.

Just like its smaller cousin, the KPC-3plus, the 9612+ TNC gives Telemetry, Beacon, GPS, and communications capability including a digipeater and 4-channel command/control channel as well. We modified our TNC to gain a total of 16 telemetry channels and 10 command I/O bits. The 9612+ TNC adds a second comm port to the TNC, offering one port at 1200 and the other at 9600 baud. We modified it for a total of 8 configurable command or I/O bits, four ON/OFF command bits, and one input bit. Because of the added 9600 baud comm port, the KPC-9612+ TNC was designed into the final PCSat design. PCSat is just one of a possible constellation of student-built satellites supporting the ASTARS Mission all based on using AX.25 TNCs in orbit.

The ASTARS Mission

The ASTARS Mission is a generic mission (supported by any TNC in orbit) to provide real-time message, position, and status relay via satellite to a worldwide Internet-linked amateur radio tracking system. Any amateur or university payload can support this mission by simply enabling the DIGIPEAT-ON function in any AX.25-compatible transponder (TNC). The users of such a relay system can be boats at sea, remote environmental sensors, cross-country

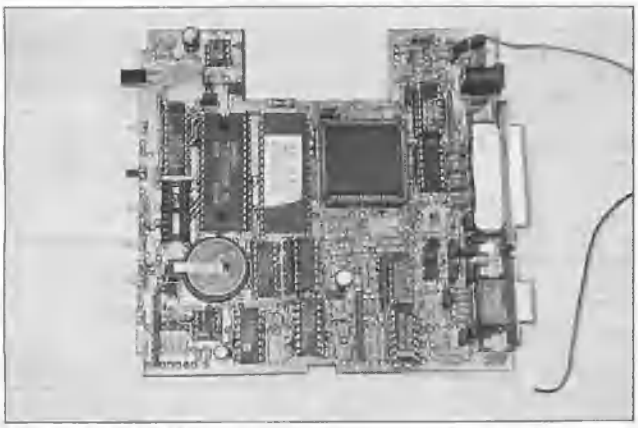


Photo A. The KPC-3+ TNC that can serve as the basis for a satellite design. For PCSat we used the dual port KPC-9612+ to gain an additional receive channel.

Photo B. Personal Communications Satellite (PCSat) with antennas.

Photo C. *Personal Communications Satellite, PCSat and design team.*

Photo D. *Chas Richard W4HFZ's mobile APRS satellite capability (including HF). With an APRS satellite, he can send and receive brief text messages anywhere on the planet a few times a day.*

travelers, expeditions, school projects, or any other travelers who are far from any existing APRS terrestrial tracking infrastructure.

The satellite downlinks from such travelers or remote sites are fed into the existing worldwide Internet-linked ground system by a few permanent ground stations. These APRS satellites would join our own PCSat and other university-built small satellites to provide connectivity to everyone involved in this mission whose birds were not locally in view.

The space segment of PCSat/ ASTARS has been demonstrated a number of times in space via *MIR* school tests, the shuttle SAREX, the SPRE mission, AO-16, UO-22, and more recently SUNSAT and ISS. Full details of the PCSat mission can be found at [http://web.usna.navy.mil/~bruninga/ pcsat.html] and [http://web.usna.navy. mil/~bruninga/astars.html].

Although the Naval Academy has been in dialog with a number of other satellite owners and designers over the last 7 years to accommodate these concepts into their designs as well (SAREX, SPRE, *MIR*, ASUsat, UO-22, and SUNSAT), PCSat will be the first satellite designed with APRS UI digipeating as the primary mission, with these objectives:

(1) Handheld/mobile live digital tracking and communications in footprint.

(2) Worldwide handheld and mobile position and status reporting (via Internet).

(3) Handheld and mobile message uplink to satellite (then to Internet).

(4) Handheld and mobile message downlink/delivery from Internet.

(5) Nationwide bulletin delivery.

(6) Low-power GPS tracking of buoys, telemetry devices, wildlife, etc.

(7) Other UI digipeating applications.

(8) Worldwide one-line E-mailing.

(9) School demonstrations and satellite lab activities.

All of these mission objectives can be met with just a simple hardware TNC on orbit acting as a UI digipeater. Also, with the sophistication and added I/O of recent TNCs designed for APRS, the TNC itself can be the command and control system. Thus no additional on-orbit CPUs are required. Not only is the satellite hardware simple, but it can be reproduced by other satellite builders to help form a constellation of these relay satellites, all operating on the same frequency to give mobile users extended access beyond what is possible with one satellite alone. This concept of a Builders' Channel for similar-mission spacecraft was presented at last year's AMSAT Symposium.[1]

Background to the mobile satellite need

Modern technology is on the move. Satellite wireless is the leading edge of technology. In the amateur satellite program, it should be a major driver for future amateur satellite missions. In just the last year, there have been many hints at the future of amateur mobile and handheld satellite communications:

(1) Growing popularity of UI digipeating via *MIR* through 1999.

(2) Continuing high popularity of AO-27 for handheld FM voice communications.

(3) Activation of UO-14 for FM voice repeater mode in February 2000

(4) Experimental UI digipeating via the UO-22 satellite.

(5) FM voice repeating via SUNSAT SO-35 throughout 1999.

(6) Recent activation of SUNSAT SO-35 for UI and APRS.

(7) Recent introduction of new TNC/ radios (Kenwood and Alinco).

(8) Dayton 2000 introduction of the upgraded Kenwood TH-D7 data HT!

The potential of two-way satellite handheld text messaging (national paging) was serendipitously demonstrated at the Dayton Hamvention during a parking lot demo of the SUNSAT downlink. Due to a scheduling error, there was no success at the expected time, so the HT was placed in a pants pocket and forgotten. But minutes later, the telltale beeping of the TH-D7 alerted me to an incoming APRS message; on inspection, it turned out to be a bulletin from SUNSAT. Thus, amateur satellite message delivery to an unattended obscured handheld transceiver was demonstrated.

ASTARS

To distinguish this APRS satellite communications system from its terrestrial

counterpart, the space segment is called ASTARS for APRS Satellite Tracking and Reporting System. This has evolved through a number of existing and previous satellite communications experiments. First was 1200-baud PSK ASTARS, which was called TRAKNET[2] at the 1998 and '99 AMSAT conferences using AO16, LO-19, and IO-26. It is a very viable capability for stations with PSK TNCs or using more recent soundcard modem uplink capability.[3] But it never became popular due to the rarity of PSK modems among most amateur satellite operators.

Satellite packet experiments using 1200-baud AFSK ASTARS, however, which any TNC can do, were demonstrated many times during experiments with the space station *MIR*[4] packet system and SAREX.[5] These experiments culminated in the June 1999 weeklong experiment via *MIR* that used the new Kenwood TH-D7 handheld with built-in 1200 and 9600 baud TNCs to demonstrate two-way self-contained APRS communications via *MIR* at 1200 baud. During this test,[6] over 55 stations conducted 2-way HT message communications.

Recently, experiments have been conducted with 9600-baud ASTARS using UO-22 and SUNSAT and the new Kenwood 1200/9600-baud APRS data mobile radio, the TM-D700A.[7] This dual-band data radio with built-in TNCs and front panel APRS displays made it possible to send and receive the very short APRS-style communications via any 9600-baud PACSAT that is digipeat-enabled (UO-22). Thus, the TM-D700 radio is an off-the-shelf satellite data terminal ready for ASTARS; it needs no PC or other accessory. Kenwood also followed suit with 9600 baud upgrades to the TH-D7(G) HT with its internal front panel displays. Alinco also now sells another integrated TNC/radio called the DR-135, which can also do both 1200 and 9600 baud built-in, though it needs an external laptop to display the APRS data.

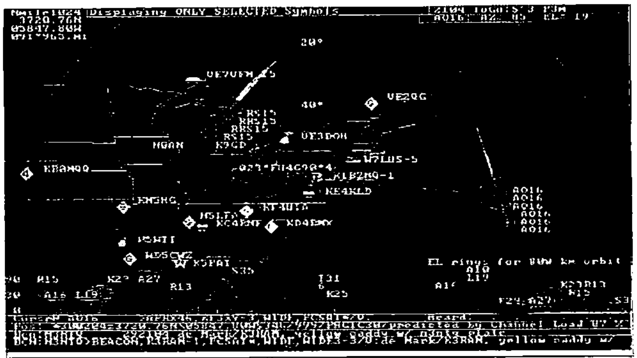
The Internet

Unlike previous amateur satellite designs, APRS satellites can capitalize on the connectivity of the Internet instead of trying to compete with it. The Internet makes possible the linking together of multiple disparate downlink sites which allows a tremendous gain in reliability through space and time diversity reception. Instead of each station requiring their own downlink receiver and then only being able to hear packets within his own footprint, the Internet allows a few stations, called SAT-gates (Satellite Igates) to combine all packets heard into the existing worldwide APRS infrastructure (APRS Internet)[8] for delivery to any APRS operator anywhere.

APRS messages

For satellite operators unfamiliar with APRS messages, it should be understood that an APRS message is a single LINE of text. Most messages stand alone, but are occasionally strung

Photo E. The front panel of the TM-D700 showing an incoming 15-byte message (messages can be longer up to 64 bytes).



All satellites are shown on the map as moving objects. Across the bottom of the screen the next 2.5 hours of satellite passes are shown in a graphic showing the maximum elevation of the pass.

Photo F. Screenshot of satellite-position display map.

together if everything will not fit on one line. **Photo E** is a photo of a very brief 15 byte message received on the TMD700 radio. Messages from mobiles are usually quite brief, as they must be entered on the touchtone pad, but longer messages of up to 64 bytes are routinely displayed.

E-mail

Similarly, APRS can send and receive standard E-mail messages via the worldwide Internet-linked APRServe system. This capability is limited, but very useful. The first limitation is that messages are only ONE LINE and the one line includes the full E-mail address. This forces BREVITY! Secondly, although E-mail can be originated under the control of the ham sending it, E-mail replies back from the Internet are only allowed via special Igates with operators who have volunteered to screen such traffic for 3rd-party legality prior to being returned to RF. Here is an E-mail transmitted from my D700 mobile en route to work. Here is how it was entered into the D700:

wb4apr@amsat testing delivery via pacsat from my van en route to work.

Yet, here is how it was received by my E-mail system after being SAT-gated to APRServe, and from there, picked up by the E-mail Engine at WU2Z's and shipped out as regular E-mail:

Date: Mon, 7 Feb 2000 07:58:09 -0500 (EST)
From: WB4APR-9@unknown.net
To: wb4apr@amsat.org
Subject: APRS Message from WB4APR-9

---

testing delivery via SUNSAT
from my van en route to work.

Message received by MacAPRS IGate station WU2Z
Located in NO BRUNSWICK, NJ
APRS path = WB4APR-9>APK101, SUNSAT*:

User ground station equipment

To design an APRS satellite, the link budget and capabilities of the users' mobile stations must be well understood. **Table 1** shows the uplink power and receiver antenna gains for all participating stations in the ASTARS system. The column labeled Standby Receive Gain is for the user who is not aware of, nor optimized for, satellite reception. For example, someone hiking with an HT in his pocket, or mobile parked under trees.

Although a wide variety of power and receiver gains are involved, these values are what form the basis of the APRS satellite design and the architecture of the overall ASTARS System.

Requirements/constraints/design drivers

To design a satellite to meet the HT/mobile communications objective and the Internet links as well, there are a number of factors involved in selecting the frequency band, antenna types, and baud rates for each of the mission objectives. First, there are a number of boundary conditions or assumptions:

(1) Optimum ALOHA channel efficiency is about 20% due to collisions.

(2) VHF links have a 9 dB advantage over UHF links (omni to omni).

(3) 1200-baud AFSK has a 7 dB advantage (measured) over 9600 baud FSK.

	ERP UHF (W)	ERP VHF (W)	Rcv UHF dBi	Rcv VHF dBi	Rcv STBY dBi	Applications
User Stations						
Handhelds	3	5	3	3	−6	Sailboats, hikers, wilderness
Mobiles	70	100	5	5	−6	Remote travelers, boats
Home stations	700	1000	13	13		Not intended for uplink
Network Stations						
I-gate receiver			7	5		Omni Internet receive site
Message node	70	100				Internet-to-user uplink site
Command station	700	1000	13	13		USNA

Table 1. Uplink power and receiver antenna gains for all participating stations in the ASTARS system.

(4) T/R delays render 9600 only twice as fast as 1200 for APRS bursts.

(5) UHF uplinks require wideband satellite receivers to avoid Doppler (–4 dB).

(6) UHF downlinks require user-tuning during pass (not desired).

With these design drivers as a guide, the following are some of the first-order alignments of requirements to hardware. From these, then, the optimum trade-offs were made to arrive at the final PCSat design.

(1) MSG delivery to HT in Standby requires best possible downlink (1200-baud VHF). Igate uplink is relatively unconstrained.

(2) MSG receipt from HT requires best possible uplink (1200-baud VHF).

(3) Downlink to Internet is relatively unconstrained.

(4) Continentwide Bulletin Delivery requires existing 144.39 over USA and 1200 baud. The same for Europe will require a common European frequency, too.

(5) HT/mobile real-time messaging requires same up/downlink and baud rates.

(6) GPS HT/mobile tracking is relatively unconstrained.

(7) Low-power GPS tracking devices require best uplink (1200-baud VHF) and the uplink must not be used by any other satellite uplinks to avoid unintentional interference to other systems.

(8) Other UI digipeating applications should be crossband full duplex and should use same up/downlink baud rates.

(9) Multiple uplink receivers to minimize collisions is desired.

(10) Synchronizing of same-band downlink transmissions is desired to maximize the available half-duplex satellite receive time.

(11) Redundancy and backups are desired.

(12) Bundling of packets in bursts amortizes individual TX delays.

(13) UHF downlinks are of little value due to poor link budget and Doppler.

(14) The KISS principle should reign (Keep it Simple, Stupid!).

Hardware alignment and requirements

Using the above criteria, PCSat was designed around two KPC-9612+ dual port TNCs. These TNCs have all the latest APRS generic digipeating advantages and can even cross route packets between ports. By using standard off-the-shelf TNC hardware and FIRMWARE, on-orbit risk was minimized due to the track record of thousands of identical hardware in use all across the country for terrestrial APRS. Thus, the firmware is proven.

Each dual-port KPC-9612+ can cross-relay from either of its two inputs to its two outputs. With only two transmitters on VHF for best downlink budget, PCSat outputs both the 1200- and 9600-baud channels to the same transmitter, one for each TNC as shown in **Fig. 1**. PCSat uses a single VHF half-duplex channel in the ITU satellite subband for its primary uplink and downlink, and one other unpublished VHF uplink. Similarly, there are one published and one unpublished UHF uplink. For the unique APRS paging downlink over North America, PCSat uses the dedicated 144.39 assignment to be able to send urgent messages from the satellite to travelers at any time who may only be monitoring the terrestrial APRS channel.

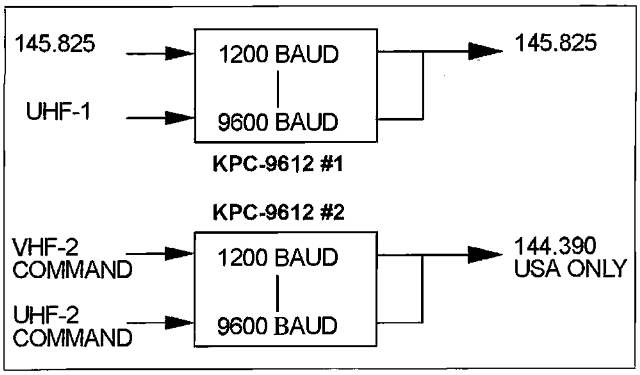


Fig. 1. The communications core of PCSat is a pair of Kantronics KPC-9612+ TNCs. Top: Standard user communications. UHF-1 is 435.250. Bottom: Command and downlink paging.

Failsafe reset

To recover from a lockup condition in these commercial off-the-shelf TNCs, PCSat uses three methods of hardware resets back to launch defaults. First, each TNC has a failsafe RESET circuit that monitors the PTT of each TNC; as long as a transition occurs at least once a minute, then the TNC is assumed to be operating correctly and the TNC remains powered up. If there are no transmissions for over 1 minute, then a one-shot timer removes power from the TNC for 1 second to allow for a complete power-up reset of the TNC.

Second, there is a 72-hour failsafe reset circuit that will reset both TNCs unless the counter is cleared by command from the ground at least once every 3 days. Third, a command bit in each TNC can be commanded to reset the other TNC.

Telemetry

Back in 1995 we defined the APRS five channel telemetry format that Kantronics subsequently has added to their "plus" TNCs. To make this usable on our satellite, the PCSat team added a 16-channel-to-four hardware multiplexer to allow telemetry to read as many as 16 values transmitted in four consecutive telemetry packets.

Link budget

The primary driver of this APRS satellite design was to deliver messages to handhelds and mobiles with only whip antennas. For this, the downlink needed to be at least 12 dB stronger than most existing digital satellites. PCSat accomplishes this by taking advantage of the 9 dB link improvement of 2 meters compared to 70cm and by using a 2 watt transmitter. Further, PCSat operates at a low transmit duty cycle unlike most existing PACSAT, because the amateur satellite population covers only 10% of the earth's surface, and with the low duty cycle of the ALOHA style of APRS operations, less than 4% of PCSat's average power budget is required for the transmitter.

Similarly, to conserve power and bandwidth, the 2-meter uplinks are reserved for only the low-power handheld stations, or stand-alone tracking devices or data collection buoys or remote WX

Mission Element	Uplink	Path	Downlink
HT Uplink of MSGS/POSIT to Internet	145.825@12	UIDIGI	145.825@12
Live HT-to-HT Footprint QSOs	145.825@12	UIDIGI	145.825@12
Live HT-to-Mobile crosslinks	145.825@12	XBAUD	145.825@96
Live Mobile-to-HT crosslinks	435.25@96	XBAUD	145.825@12
Mobile Uplink of MSGS/POSIT to Internet	435.25@96	UIDIGI	145.825@96
Live Mobile-to-Mobile Footprint comms	435.25@96	UIDIGI	145.825@96
Command and Control	All	MYRemote	145.825
Other UI Applications	TBD	UIDIGI	145.825
Low-Power Trackers	VHF2	UIDIGI	144.39 USA
Nationwide Message Delivery	UHF2@9600	MYgate	144.39 USA
Nationwide Bulletin Delivery	UHF2@9600	MYgate	144.39 USA

Table 2. *Channel usage and mission objectives.*

stations such as the one built by Ronald Ross KE6JAB in Antarctica.[9] The mobiles and SAT-gates which have 35 to 50 watt transmitters will be asked to operate only on the UHF uplink frequencies where they can afford the more difficult link budget. The result is the further advantage of having spread out the user base over 4 uplink channels to minimize collisions.

Channel usage and mission scenario

Table 2 maps the mission objectives into the various uplinks and downlinks on the satellite. It matches the strengths and weaknesses of each mission area to the available link budgets and hardware.

Notice the advantage of incorporating the single North American continentwide coordinated APRS frequency into the downlink frequency plan. Although this frequency is in use by over 2,000 users full-time including over 600 wide-area digipeaters, it is a well established universal frequency where ALL APRS operators can be found whether they are aware of a satellite pass or not. Actually, although 90% of the USA ham population is within range of this terrestrial infrastructure; 70% of the land mass is not, so travelers are often out of range of the terrestrial links.

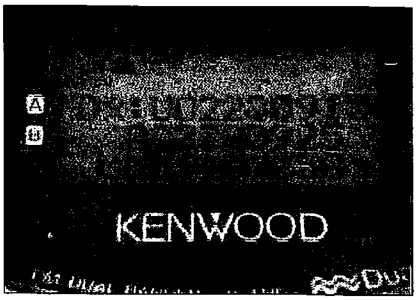


Photo G. *Screenshot of the TH-D7 showing the next 80-minute satellite schedule.*

Due to the shared use of 144.39 with the thousands of existing users, this downlink on 144.39 will ONLY be used for the special applications consistent with the national significance of this channel. Such applications might be getting an emergency or priority message to an existing APRS mobile no matter where he is; infrequent bulletins of national interest; and low-power but high-profile tracking of special devices (for example, the Olympic Torch). Due to the low duty cycle channel statistics of an ALOHA TDMA channel like APRS, even though the channel is in full use by thousands of users, still more than 50% of the time, the channel is "clear" as heard by any mobile anywhere at any instant.

SAT-gate operations

The mobile-to-mobile and HT-to-HT communication missions work without any special considerations on the satellite or on the ground. But the more useful application is sending and receiving messages to any other APRS station worldwide by having the packets received by the SAT-gates that are monitoring the satellite downlink and feeding every packet heard into the APRS Internet system. These SAT-gates need to perform the following functions:

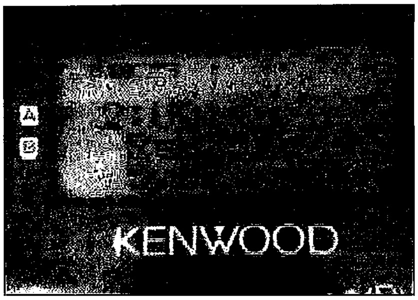


Photo H. *Showing the range and downlink frequency of UO-14.*

(1) Monitor both downlinks and feed ALL packets into the Internet.

(2) Maintain a track on all calls heard via satellite.

(3) Monitor the Internet and capture MESSAGES for these calls.

(4) Deliver these messages at a "fair" rate under these conditions:

a. The satellite is within 1400 km (above 30 deg) to mobile.

b. It sees "QRZ" in the mobile's STATUS text or CUSTOM-3.

c. Deliver these messages until seen in the downlink 3 times.

Omni no-track SAT-gates

Setting up a SAT-gate is trivial, requiring nothing more than a normal packet station and omni antenna. Any APRS station can do the basic feding (#1 above) with existing software which contain the built-in Igate capabilities. Even if the station does not have horizon-to-horizon coverage, they are only contributing their packets to the same worldwide stream as all the other Igate receivers, so any station can help. Unlike any previous amateur satellite activity, PCSat will use the Internet to combine the outputs from a dozen such stations nationwide; the result is over a 99.96% chance of

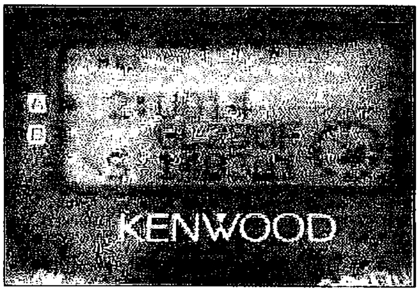


Photo I. *Showing the direction and distance to the satellite.*

capturing every packet over the USA! Even if only 4 stations at any one time have the bird in view of their station and even if they only have a 60% chance of decoding each packet, their combined probability is 98%. But if the original packet is replicated TWICE, then this probability becomes 99.96%! A certainty!

Base station operations

Since the APRS satellites are shared assets with limited bandwidth, this message system should only be used by mobiles who have no other means to communicate from distant locations. For this reason, base station operations are not encouraged other than SAT-gates or for direct contact with a mobile if needed. A Mic-E-style packet from the D700 is only 9 bytes long, compared to a typical WinAPRS 80-byte position report. Thus, base station transmissions are discouraged.

Satellite tracking and pass predictions

To help with satellite tracking for the casual and mobile user, satellite tracking has been added to APRSdos in the form of APRStk.exe. When run within an existing APRSdos file structure (so you get all the maps and other built-in-data), it presents the satellite predictions on the APRS map and will autotune the Kenwood radios, including Doppler. It is available zipped up as a complete system for download from [ftp://tapr.org/aprssig/dosstuff/APRSdos/aprstk.zip].

Distributing live SAT tracking data to mobiles

Another version of the same APRSdos derivative is called APRSdata.exe. It has the unique feature that it can distribute via the terrestrial network sufficient pass information for display on the front panel of the Kenwood radios so that other travelers are aware of pass times long before they drive out into the wilderness. Not only does this put this special satellite pass info directly on the mobiles' radios, but it also posts the satellites in view as objects to the local 144.39 network so that all mobiles can see the range and azimuth to the satellite as well as the up- and downlink frequencies. Thus, our mobile satellite users can get the PASS info they need without lugging along a laptop.

The screen-shots show what the TH-D7 HT will capture and display about the satellites while monitoring the terrestrial network if an APRSdata.exe station is in range.

First is the DX-SPOT list, showing that there are three satellites, UO-22, AO-27. and UO-14 coming up in the next 80 minutes and when.

The next two screens show up when the satellite is in view. They show the range, azimuth frequency, doppler, and distance to the satellite. Just perfect for aiming your handheld antenna. For more details on this resource for non-PC distribution of satellite info, see the Web site: [http://web.usna.navy.mil/~bruninga/satinfo.html].

The power of this on-line, real-time delivery of current satellite pass data to mobiles and handheld users without the need for a laptop is in itself a brand new opportunity for the amateur satellite service. Already it has been expanded to hundreds of other data screens that can be pushed to these radio displays. We call them Tiny Web Pages.[10] Although this application is beyond the scope of this paper, the ability to deliver these Tiny Web Pages to any HT/mobile anywhere on the planet with the combined resources of the existing APRS infrastructure and the ASTARS amateur satellites.

Conclusion

The time is ripe for extending amateur satellite digital communications services to mobile and handheld users. Since packet was first introduced on space shuttle mission STS-35, there have been numerous experiments to test and validate the capability for using UI packet digipeating for real-time digital communications between users. This combined with the recent maturity of the Internet as a global resource for exchanging data worldwide suggests that there is a unique opportunity to join the advantages of the Internet and amateur satellites as a means of tying together SAT-gates throughout the world where the infrastructure exists to extend worldwide amateur communications to mobiles in areas where it doesn't exist. And, rather than starting such a global system from scratch, the APRS protocol and worldwide Internet infrastructure provides a means of packaging and delivering and displaying this type of real-time traffic to users both on the satellite downlink and worldwide via the Internet.

The introduction of the Kenwood and Alinco integrated TNC/radio combinations and the Kantronics TNCs give us off-the-shelf solutions for providing mobile and handheld satellite communications terminals to all users. By encouraging UI digipeating as auxiliary payloads on most small satellites, the amateur satellite service can bring all of these pieces together into the most powerful and far-reaching amateur satellite project to date.

Footnotes

1. Satellite Builders' Channels, 17th Annual AMSAT Symposium, pp. 191–195.
2. [http://web.usna.navy.mil/~bruninga/traknet.html].
3. [http://members.aol.com/dquagliana/upw/index.html].
4. [http://web.usna.navy.mil/~bruninga/mirex.html].
5. [http://web.usna.navy.mil/~bruninga/sarex.html].
6. [http://web.usna.navy.mil/~bruninga/mir-ht.txt].
7. [http://web.usna.navy.mil/~bruninga/TM-D700A.gif].
8. [http://web.usna.navy.mil/~bruninga/www.aprs.net].
9. "Antarctic Expedition," *AMSAT Journal,* Winter 2000.
10. Tiny Web Pages, ARRL/TAPR Digital Communications Conference, 2000.

Frank H. Bauer KA3HDO
Lou McFadin W5DID
Will Marchant KC6ROL
Carolynn Conley KD5SJO

All Aboard for ARISS ...

Amateur Radio on the International Space Station.

In 1996, after the first International Partners meeting of the newly formed Amateur Radio on the International Space Station (ARISS) team, we all walked away "cautiously optimistic" that we would be able to develop, deploy, and operate a ham radio station on the ISS. This optimistic dream from a handful of internationally-based amateur radio operators has now turned into reality. The year 2001 will go down in history as the year that the ARISS amateur radio station became fully operational.

It was a good thing that those involved in the hardware development and deployment had no idea of the significant challenges that faced them. Otherwise they would have all quit prematurely. The challenges that this international team endured were immense. We were the first "payload" to fly on ISS and no one — USA's NASA or the Russian Space Agency — really knew how we should be qualified. We repeated several flight qualification tests 2 and 3 times to satisfy all the different organizations' requirements — the Shuttle, the USA ISS team, and the Russian ISS team. We also had to overcome the cultural differences and hurdles that result from working as a fully integrated international team. A couple of weeks prior to the launch of the initial ISS ham radio hardware, we were still hanging on the edge of a precipice. The issue this time was that we had not satisfied the Russian EMI requirements. But we persevered, we made it happen.

This article will provide an overview of the equipment currently on board the ISS, the hardware currently in the queue for deployment over the next 12 months, and our long-term vision for the future. We will also provide ground-based hams the information they need to hear and work the ISS crew.

Human spaceflight and amateur radio — a perfect pair

The Amateur Radio on the International Space Station (ARISS) represents a melding of the teams that have pioneered the development and use of amateur radio equipment on human spaceflight vehicles. The Shuttle/Space Amateur Radio Experiment (SAREX) team enabled Owen Garriott W5LFL to become the first astronaut ham to use amateur radio from space. Calling "W5LFL from the Space Shuttle *Columbia*," Owen made hundreds of QSOs on the STS-9 space shuttle mission in 1983. Since then, amateur radio

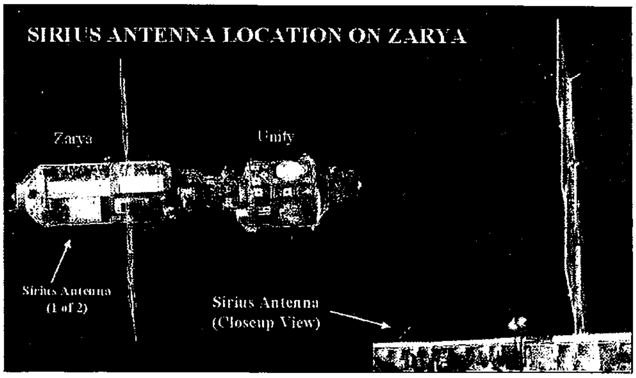


***Photo A.** FGB 2-meter antenna locations.*

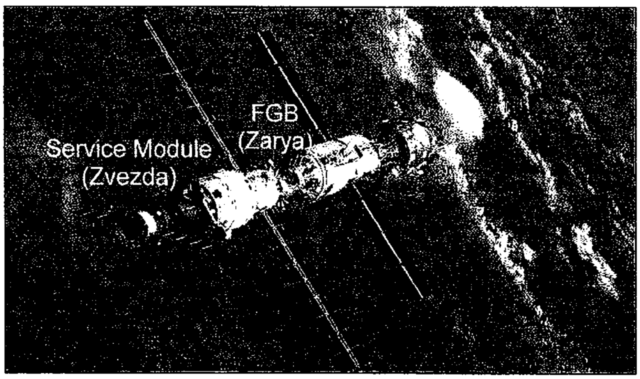


***Photo B.** Service module and FGB.*

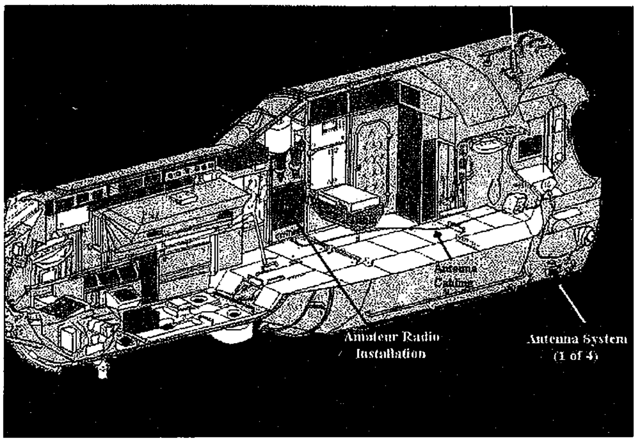


Photo C. ISS ham hardware location in service module.

teams in the U.S. (SAREX), Germany (SAFEX), and Russia (Mirex) have led the development and operation of amateur radio equipment on board NASA's Space Shuttle and the Russian *MIR* space station. The ARISS team, a delegation of 10 countries, was formed in 1996 to develop, fly, and operate ham radio equipment on the International Space Station.

Through ARISS, the ham radio community can talk to the astronauts and cosmonauts on board the ISS. The primary goals of ARISS operations are fourfold:

(1) educational outreach through crew contacts with schools;

(2) random contacts with the amateur radio public;

(3) scheduled contacts with the astronauts' friends and families; and

(4) ISS-based communications experimentation.

A few schools are selected from around the world for scheduled contacts with the orbiting ISS crew. At least ten students at each school ask the astronauts questions, and the nature of these contacts embodies the primary goal of the ARISS program — to excite students' interest in science, technology, and amateur radio. More than 200 schools have participated in a scheduled contact since the first amateur radio equipment was flown on the Space Shuttle.

Ham shack location

The ISS ham equipment will reside in two locations. 2-meter operations will primarily be conducted in the Russian Functional Cargo Block (FGB) named *Zarya,* using Russian antennas used to dock the FGB. These antennas, designed for use near the 2-meter band (see **Photo A**), are no longer used by the Russians and can be used by the ISS ham team permanently. This is the current location of the ISS ham radio station.

In late 2001, a set of 4 antenna systems developed by the ISS ham team are expected to be deployed. Once these antennas are deployed and checked out, the primary location of the ham shack will reside in the Russian Service Module (SM) named *Zvezda*. See **Photo B**. The ham station will be installed at location 426 in the SM, right next to the dining table. See **Photo C**. Simultaneous multiband operation can be conducted with these two ham shack locations.

Hardware overview

The initial ISS ham radio system was launched on board the STS-106 Space Shuttle *Atlantis* on September 8, 2000. The initial ISS ham radio hardware consists of two handheld Ericsson transceivers, a power adapter, an adapter module, an antenna system, a packet module, a headset assembly, and the required cable assemblies (see **Fig. 1** and **Photo D**). The ham radio station is capable of operating in either the voice or data (packet) mode with amateur stations within line-of-sight of the ISS. This configuration can be operated in the attended mode for voice communications and either the attended or automatic mode for packet communications. The function of each of the components that comprise the ISS ham radio is summarized below:

1. Handheld Ericsson (M-PA Series) transceivers — There are two transceivers on board: A VHF radio that receives and transmits FM voice or packet radio signals in the two-meter (144 to 146 MHz) amateur band, and a UHF radio that receives and transmits FM voice or packet radio signals in the 70 centimeter (435-438 MHz) amateur band. Both radios are Ericsson M-PA-series commercial-grade radios. These radios look identical in size and features, but are specially tuned to support the different bands. Each radio is

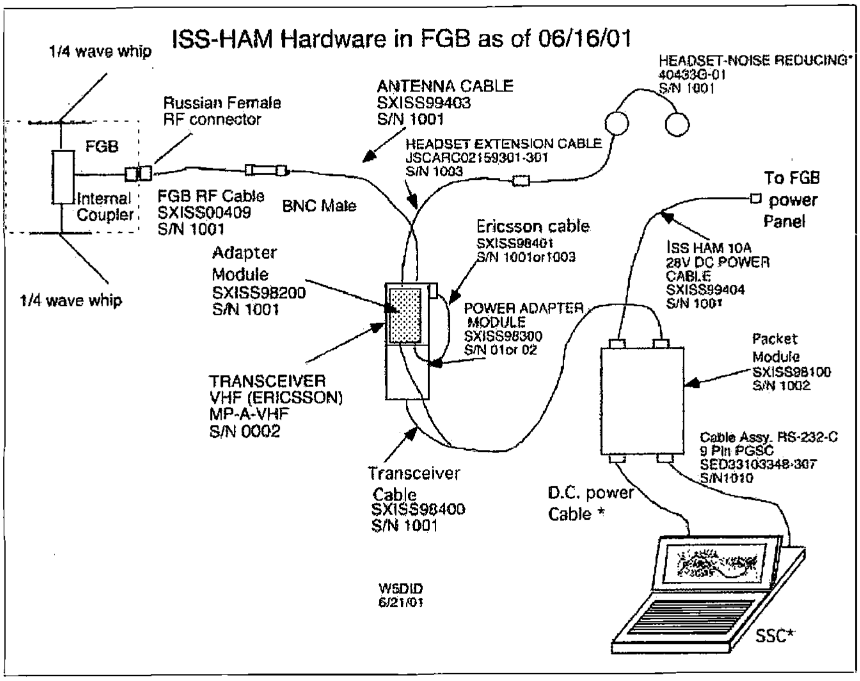


Fig. 1. ISS ham hardware configuration.

Photo G. Packet module.

Photo H. Headset assembly.

Future hardware deployments:

Packet module upgrade

To date, the packet system has not been connected to an SSC laptop due to the lack of sufficient laptops on ISS. Also, shortly after the packet system was turned-on for general use, it was discovered that the battery used to backup the RAM had died. Because of these two events, the packet system has been operating in digipeat mode using the ROM defaults (including the NOCALL callsign). An upgraded packet module is expected to correct these problems and add new capabilities. The new TNC will include a specially developed ROM with the standard ISS ham defaults, Russian and USA labels, a new battery, and extended memory (up to 1 meg). Since the packet module serves as the power supply for the station, the ARISS team has decided to leave both packet modules onboard ISS. The older version will serve primarily as a power supply for one of the stations (FGB or SM). The newer version will provide the packet radio capability. The new packet module was launched on the STS-105 *Discovery* mission on August 10th, 2001.

Antenna assemblies

The specially designed ISS ham antenna assemblies will permit operations on HF (20 meters, 15 meters, 10 meters), VHF (2 meters), UHF (70cm), and the microwave bands (L and S band). The dual-use antennas also permit the reception of the Russian Glisser EVA video signals (2.0 GHz). This dual-use capability is the primary reason the ARISS team received access to 4 antenna feedthroughs located on the outside of the service module. A

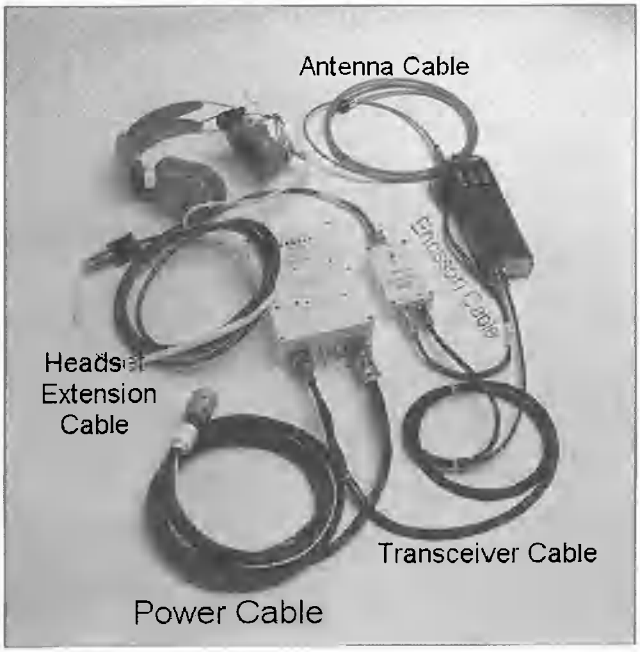


Photo I. Equipment cables.

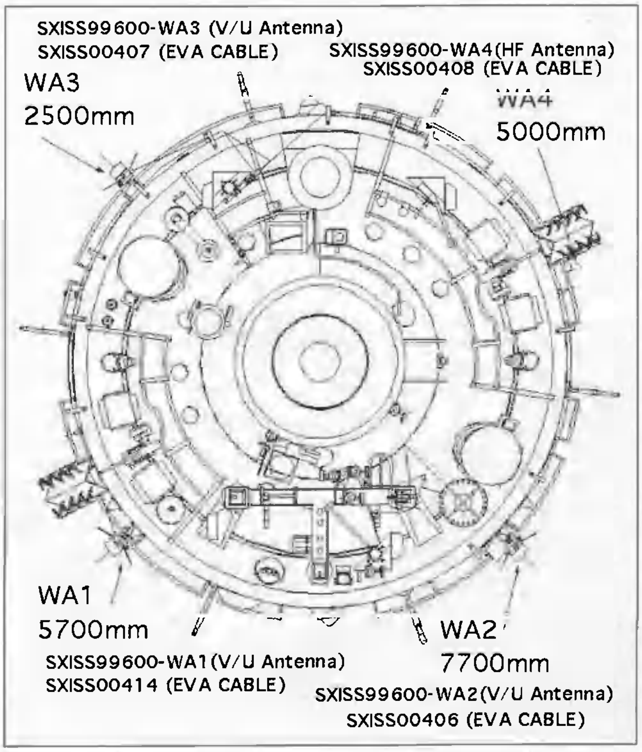


Fig. 2. Antenna location view from end of service module.

Photo M. EVA training for antenna installations.

somewhat the "luck of the draw." However, with careful planning and a good ground station, your chances of operation are significantly improved. Several hams have made contact with the ISS using an HT. However, a directional antenna using a radio capable of producing at least 25 watts of power is recommended. The crew is usually awake from 7:00–22:00 UTC. They only operate the station in voice mode during their "off" time, so lunch time or early morning/late evenings are good times to listen. Packet operation is available almost continuously. Check [http://ariss.gsfc.nasa.gov] and [http://www.ariss.net] for information about operating the ISS packet and the current status.

The ISS ham station uses the following callsigns: U.S voice operations, NA1SS. Russian voice operations, RSØISS. Packet operations, RSØISS-1 (as of August 19th, 2001, NOCALL was still in use).

The frequencies of operation are all split. The following frequencies are used for ISS general QSO operations: Worldwide downlink, 145.80 MHz. Voice uplinks: 144.49 MHz — Regions 2 & 3 (Americas, Australia, Asia); 145.20 MHz — Region 1 (Europe, Africa, Middle East). Packet uplink: 145.99 MHz (worldwide).

Expedition 2 astronaut Susan Helms KC7NHZ, has been extremely active on the ham radio station. Her outstanding efforts as the first Field Day contester from space infused a lot of enthusiasm into the worldwide amateur radio community — making this a Field Day that many will remember for the rest of their lives.

Astronaut Frank Culbertson KD5OPQ has now assumed the role as the ISS Expedition 3 commander. Remember that the Expedition 3 crew will be very busy, and it will probably take them some time to get comfortable enough on board the

Continued on page 59

Photo N. SSTV hardware and software.

Photo O. SSTV computer interface.

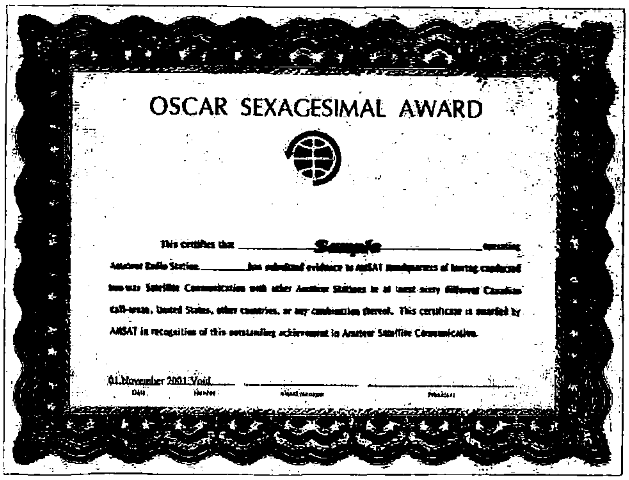


Fig. 3.

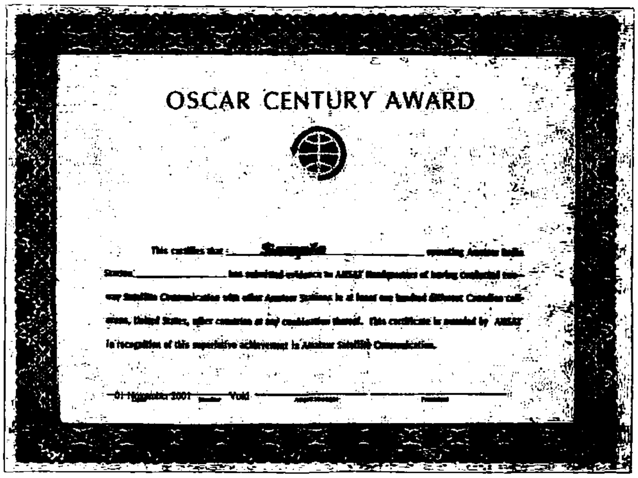


Fig. 4.

AO-21 (no longer operational), AO-27 and RS-10/12/15. The costs for this award are the same as the previous AMSAT Awards and are also sent to the AMSAT Awards Manager.

The next AMSAT award is the W4AMI Satellite Operator Achievement Award. This award requires no confirmed QSL cards but does take a bit of record keeping. You get credit for each 1,000 satellite QSOs up to 5,000. Please submit your log (computer generated or handwritten) to W4AMI, Awards Manager at AMSAT Headquarters. The cost is the same as the previous awards.

The ARRL sponsors several awards. They are the Worked All States (WAS) Award with Satellite endorsement, the VHF/UHF Century Club (VUCC) Award, the DX Century Club (DXCC) Award, and the Worked All Continents (WAC) Award.

For Worked All States, you must work someone in each of the 50 states through any amateur satellite in any mode. For the VHF/UHF Century Club Award, you must work someone in 100 different grid squares. Endorsements are available for every 25 grid squares after the first 100. The final award, DXCC, requires you to make a satellite QSO with 100 different DXCC countries. For Worked All Continents, you work someone on each of the 8 continents. More information on these awards can be found on the ARRL's Web site, [http://www.arrl.org], then click on Operating Awards.

Finally, I would like to introduce the newest AMSAT Award. It starts with contacts on or after November 1, 2001. The award is the AMSAT Elmer Award. The complete rules for this award are as follows.

New AMSAT Elmer Award

This award has 3 levels: Beginner, Intermediate, and Expert.

Beginner Level

Work 1 School Club Station

Work 4 YL Ops

Work 4 Young Ops (16 and younger)

Work 10 Ops that have had their license for less than 2 years at the time of contact

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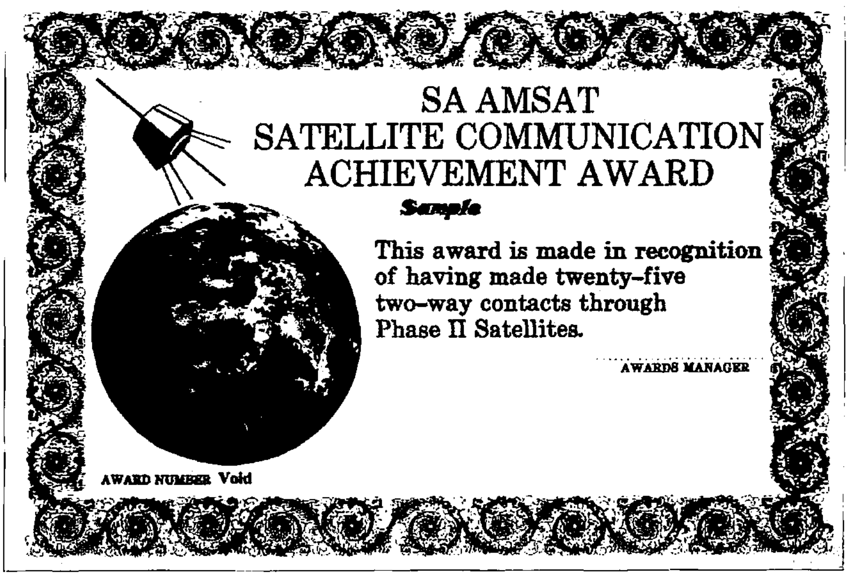

Fig. 5.

Callsign	Date	UTC	Satellite	Category
ZZ2ZZ	05 Nov 2001	0300Z	UO-14	YL
ZZ1ZZ	06 Nov 2001	0415Z	UO-14	YL
ZZ1ZY	06 Nov 2001	0425Z	AO-10	Teen
ZZ1ZX	07 Nov 2001	0530Z	AO-10	First
ZZ3ZX	07 Nov 2001	0530Z	AO-10	New
ZZ4AA	08 Nov 2001	0400Z	UO-14	School

Table 1. Sample award submittal.

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3 Bennys Way
Coton
Cambridge
CB3 7PS
England
[G3RUH@AMSAT.org]

A Modest Proposal

Prophesied nearly a decade ago, S-band has come of age with the Oscar-40 spacecraft. With some revealing insights, here's why.

Government health warning: Facts can seriously damage your health. This article contains facts.

I have never been given much to arguing matters of a speculative nature. If I don't know about something, I keep quiet. If I do know, I say what I know. I will tenaciously defend any proposition that is a demonstrable fact, that can be supported and extended by reasonable analysis. So ...

In this article, I want to make a case for abandoning 145 MHz Phase III satellite downlinks. I will show why S-band (2400 MHz) is an infinitely better proposition. I will dispel the myths that S-band requires special knowledge, enormous expense, huge dishes, and a "techie" mentality. These are totally untrue. S-band in practice is far simpler and cheaper, and far more efficient than 145 MHz. I will not make my case with airy-fairy hypotheses. I will do it from practical experience. Show and tell.

Please don't read this article with a cynical smile and an "Oh, here's just another wirehead evangelist on his soap box showing off." Read it and think about it. I have seen the future, and it works! Now it's your turn.

Originally published in *Oscar News* (UK), October 1992. 2001 updates at the end.

Brain ON

Time for a thought experiment. Consider this: Oscar-13 carries a mode-S transponder plus beacon. The transmitter outputs 1 watt to a 5-turn helix. That makes an e.i.r.p. of 10 watts. This is peanut power. Given that, what size antenna do you think is needed to receive the beacon comfortably? As comfortably as at 145 MHz. A 2-meter dish? 4 meters? Several 55-element loop yagis? No idea?

Skip the arithmetic until later. Will you believe that the answer is a puny little two-foot-diameter dish! Yes, it surprised me too. So, to prove it, I built a 60cm dish antenna from a spun aluminum lampshade I picked up when a local furniture store closed down. Cost me a couple of quid. OK, four quid; I bought two of them.

Sure enough, the Oscar-13 mode-S beacon was at least as strong as the 145 MHz beacon. And the transponder signals effortless copy, noisefloor included. And will you also believe me when I tell you that this little dish still worked excellently indoors, through a closed window?

A straight choice

Now, answer this question honestly. If you had to choose between your huge 145 MHz downlink antenna, and a tiny 60cm lightweight, compact, suitcase-size, no-tune, elegant dish that you could genuinely hitch to a balcony; which would you have? No contest, is there?

What noise annoys?

What's the reason for this surprising result? The answer is simple. Noise.

145 MHz is noisy. In many places, it's so noisy as to be totally unusable. I don't think there is much disagreement about this. Noise arises from almost everything electrical you can think of. Transport, illegal taxis, defective appliances, weather, sun, sky, QRM, splatter, teleswitches, computers; the list is endless. And it's getting worse every year. I haven't even included noise of the receiver; it's usually swamped by the foregoing.

A measure of 145 MHz noise

To quantify noise, we use a measure called noise temperature. Higher is worse. It's the temperature of a 50-ohm resistor that, if connected to the radio instead of the antenna, would make the same racket. The noise temperature on 145 MHz is of the order of 1,000K

to 1,500K. In some conditions it may be less, but usually it's a lot more. Let's just use 1,200K for now.

By the way, K means kelvins. Zero kelvin is total silence, water freezes at 273K, boils at 373K, and 300K is a nice day.

The important thing to grasp is that there is nothing you can do about this noise. You cannot reduce it. Even with a hypothetical zero-noise preamp, you will still have 1200K of noise.

2.4 GHz noise is rather different

Now, let's look at noise on 2400 MHz. Sky noise, nil. Environmental noise, nil. Cable losses, nil (no cable). FT-736R noise, nil; there's a preamp/converter at the antenna. Antenna noise, almost nil; just some pickup of the warm earth from the side lobes, 20K maybe.

The only real source of noise is the 2400 MHz to 144 MHz downconverter. And this noise is totally under the control of the equipment designer.

A converter consists of a low-noise preamplifier stage followed by a mixer. The mixer is driven by a 2256 MHz local oscillator, usually a 94 MHz crystal with x24 multiplier. Very simple. Very cheap.

The noise level of a typical low-cost converter is about 100K. Let's assume this, although lower is achievable, and add 20K for antenna side lobes. That makes a total of 120K of noise for 2400 MHz. Guaranteed, every time, everywhere, worst case.

The big payoff

So, where does that get us? We have established that 145 MHz noise = 1200K, and on 2.4 GHz, it's 120K. That's a factor of 10x quieter at least.

It means that for a given spacecraft transmit power, your ground station antenna on S-band can be 10 times smaller than for the 2-meter band. Why? Because less noise means less signal needed. Received signal strength is directly proportional to the capture area of the antenna. Capture area is proportional to physical size.

That "10 times smaller" means less mechanical engineering, less windage, less cost, less maintenance, less environmental impact, greater portability, and so on and on.

Just as important, the noise level is controllable by the user (you), not by external influences beyond your control. Isn't that just what we want from a satellite communications system? I think so.

Exploding 2.4 GHz myths

1. S-band is for "techies."

Complex, a mystery, deep stuff. Three days before writing this article, I knew nothing about 2.4 GHz. I still know nothing. I don't need to know. And I don't know much about 145 MHz, either. Do you? Do you, honestly?

I made a small dish from materials I had on hand using no more than simple dish formulas available from the *ARRL Handbook* and elsewhere. I made a 2-1/4-turn helix feed from a bit of H100 solid coax inner wound around an 40mm socket spanner from my car toolkit. I soldered it to the pip of an N-type panel connector, which was mounted on the 125x125mm reflector of 1.6mm aluminum sheet. I bought an SSB Electronic UEK-13 S-band converter from a regular advertiser, coupled it directly to the N-type, and fixed the whole assembly to a 1/2"-square aluminum boom with two elastic bands! The boom ran through the hub of the "lampshade" dish, with overhang for mounting purposes. The RG-174 coax (3mm diameter) and 12 volt feed ran neatly back inside the hollow boom.

"Scrap" it may be, but it looks professional enough to me. The most technical thing I used was a hand drill. Or was it a hack saw? Took 5 hours to build from a heap of bits to being on the pole ready to test with AO-13. And I was designing as I went. I did no electrical alignment of the helix feed. Like most, I have no test facilities for 2.4 GHz; probably never will have.

If this story labels me a "techie," heaven help blacksmiths!

2. S-band is expensive.

Successful 145 MHz downlinks require a large antenna and a preamplifier. If the system is used for transmitting, as is usually the case, it also needs low-loss coax.

An S-band converter costs about the same as a good 2m preamp. The dish I described cost almost nothing. A commercial version (if it were available) would doubtless cost no more than a KLM14C. Coax can be RG-58 or smaller.

So, at commercial rates there is probably no difference. But build your own antenna which, as I have shown, is almost too easy, and S-band is a lot cheaper.

3. S-band requires a huge dish.

As already explained, this is not the case. The size of a receive antenna is dictated by the size of signal you want to receive. This is dictated by what signal-to-noise ratio you want. This is constrained by the noise level. So, let's do an exercise for a very small lampshade dish and the "120K" converter mentioned. Fear not; what follows is arithmetic only! Calculators out, now.

Calculator ON

Suppose the satellite transmits Pt watts. This spreads out in all directions over an imaginary sphere of radius R, say 40,000 km for AO-13. The energy is intercepted on this huge sphere by a tiny antenna of effective diameter D, say 40cm for a typical 60cm dish. So the power it picks up, Pr, is just the ratio of antenna area to the sphere area, that is:

$$Pr = Pt * (\pi D^2/4) / (4\pi R^2)$$

If you plug in the numbers for AO-13 with Pt =10 watts, you get Pr = 6.3 x 10^{-17} watts.

Now, let's calculate the noise power Pn received. This is easily found from the standard noise formula:

$$Pn = KTB$$

where:

$K = 1.38 \times 10^{-23}$ W/Hz/K, Boltzmann's constant.

T is the noise temperature in kelvins which for this article we took to be 120K on 2.4 GHz.

B is the receiver bandwidth; assume 2.7 kHz for a typical SSB receiver.

Plug in the three numbers, and the received noise power is $Pn = 4.5 \times 10^{-18}$ watts.

So, the signal-to-noise ratio, SNR = Pr/Pn. Dividing the signal and noise powers just calculated, you get, for AO-13's beacon at 40,000 km on a 60cm dish in an SSB bandwidth, SNR = 14 or 11.4 dB.

And believe me, it IS just that; I measured it. No tricks, no bull. Just simple arithmetic. So much for the "big dish" theory. A modest antenna is all that's required.

Outline transponder budget

You can extend these figures to a transponder downlink design by scaling.

Assume 40 users (100 kHz bandwidth), a 20 dB SNR (6 dB more, x4) and you need 40 x 4 = 160 times as much satellite e.i.r.p. That makes 40 real watts to a 16 dB gain spacecraft antenna, say, a 15-turn helix or 25cm dish. Extremely practical. And remember, the ground station is still a 60cm dish.

The ability to realize large 2.4 GHz gain on the satellite with physically small spaceborne antennas, a task that's virtually impossible at 145 MHz, means that we have the ability to design a system free from the constraints of the Ariane rocket third-stage envelope. That's a priceless advantage.

More bunkum

By the way, I hope you noticed that this systems analysis failed to speak of "path loss," "noise figure," and "antenna gain"!

Nor should it have; these terms are just obscurations. There is no such thing as "path loss"; space is loss-free. The term was invented by nomograph manufacturers as a convenient stepping-stone on their gadgets.

"Noise figure" (in dB) is another meaningless number invented by preamp manufacturers to increase sales. Daft! If they used noise temperatures instead, they would sell rather more, because those numbers are far more impressive. They are certainly more intuitive.

"Gain" is useful only when talking about transmitting or if you are trying to sell antennas. For receivers, capture area is a direct measure and again, far more meaningful. For reference, G = 4p Area/Wavelength^2.

Disadvantages of S-band downlinks

So far as I have been able to discover, the only impediment to S-band signals is tree foliage. This seems to me to be a rather trivial drawback. I should like to hear if there is anything else technically negative. Perhaps some of the real techies (not the armchair ones), who have all the answers but never tell, could come forward!

Disadvantages of 145 MHz downlinks

I don't want to labor the point! The honest truth is that AO-13's 145 MHz downlink does have serious shortcomings. Noise is high, and big antennas and highest quality receive technique are required. Many fail at this hurdle and give up. Others reach for their wallet. It is nothing like as easy as it was envisaged all those years ago. It doesn't have to be like this.

Phase 3D

We don't have to repeat the mistake with P3D. Cranking up the 145 MHz downlink power is no solution. It's a short-term delusory crutch that will simply hobble us for another decade.

Isn't it time we took a careful, unbiased look at the options? And surely, before jumping to contusions, budding analysts should at least try AO-13 mode-S?

I promise that you will be astounded at its simplicity and at its performance. You don't have to habitually use it for ever after. Indeed, its experimental hard limiting design won't support hoards of users. Just try it, so help me! The equipment can be put by for the future, or lent to others. It won't be wasted. Are you willing to stand up and be counted?

Well?

[End of original article; the following added August 2001.]

2001 footnote: Oscar-40

The foregoing was written in September 1992. I'd gone from zero S-band understanding to total conversion in the space of 24 hours. Staring up at a huge, tower-mounted 2m yagi, and a diminuitive S-band antenna giving the same performance, sent me straight to the keyboard in a blaze of inspiration. I have not changed a word.

Things have improved. Oscar-40 has an S-band transmitter capable of 40–50 watts output, connected to a 5-turn helix, with gain 10 dBic. This is a lot of radiated power; beacon signals and voice signals are predictably very strong indeed, greatly surpassing the experimental system of Oscar-13.

S-band receive technology has evolved rapidly, and whilst surplus converters are available, generally having early '90s performance of 170K (2 dB), off-the-peg contemporary equipment boasts noise temperatures of 40K to 50K (0.6dB), which is commensurate with the baselines of irreducible sky noise and antenna sidelobe pickup. You get what you pay for; the performance difference between the old and new just cited is about 4 dB, and is not a margin to be squandered lightly.

S-band antenna design and construction continues to exercise mind and body for many hams, with predictably mixed results! Commercial offerings are also available, which was scarcely the case a decade ago.

S-band is now mainstream hamming; plug 'n' play, and there is now no excuse for holding back. Oscar-40 beckons seductively.

Just do it!

Russ Tillman K5NRK
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Vicksburg MS 39183-1203

Risky Business

That's one way to describe designing our next radio amateur satellite.

What do you want the next amateur radio satellite to do? Ask that question of 100 hams who are interested in amateur radio satellites and you will probably get 100 different answers — some from folks who are very vocal and strongly animated about their opinions. Also, ask these same folks how to build this satellite and you will also get 100 different opinions. Such is amateur radio satellite-building, such is AMSAT.

This article presents efforts to-date in planning and designing AMSAT's next satellite and how some of the tough choices and decisions are being made for the benefit of the amateur radio community. In this article, "AMSAT" refers to the worldwide alliance of AMSAT organizations that contributed to designing, building, launching, controlling, and funding Phase 3D/AO-40.

Learning from the Phase 3D/AO-40 experience

After many years of hard work, Phase 3D successfully soared into orbit on November 17, 2000, via an Ariane 5 rocket. The day after launch, AMSAT-NA Chairman Bill Tynan W3XO, who is responsible for numbering amateur radio satellites, christened Phase 3D "AO-40" as it began its extensive and interesting commissioning process towards eventual operation. While the road to a successfully operating AO-40 spacecraft has been long, bumpy, and difficult, users are now starting to see the fruits of builders' efforts with an extremely operational AO-40. As most hams know, this long and interesting process tested and stretched the capabilities of the numerous organizations that were involved in designing, constructing, testing, launching, and commissioning Phase 3D/AO-40. This project also tested and stretched the support and perhaps patience of the amateur radio community, whose generous contributions funded development and launch expenses. Whether AMSAT will undertake another Phase 3D/AO-40 project is certainly debatable; however, the opportunity to place 650 kilograms of amateur radio mass into a highly elliptical orbit appears to be a once-in-an-organization opportunity. That is, AMSAT will probably never get the opportunity to do that again. So we made the best of it and the results of our efforts are beginning to pay good dividends. And, there are many on-the-ground benefits that we are continuing to derive from the Phase 3D experience. For example, AMSAT and its sister organizations have developed a network of experienced satellite builders, many of whom have cut their teeth on the construction of Phase 3D. As a result, the experience gained from the Phase 3D project is already proving that it will be beneficial to AMSAT for many years to come, starting with the design of the next AMSAT satellite.

Life after Phase 3D

Even before Phase 3D went into orbit, the AMSAT-NA Board of Directors was already discussing plans for the next endeavor. One of the first items of discussion at the October 2000 AMSAT-NA Annual Meeting and Symposium in Portland, Maine, was life after Phase 3D. At that meeting, the Board of Directors resolved the need for AMSAT to begin defining the next project. Their intent was to capture and keep the momentum and experience gained from the development of Phase 3D and carry that momentum over to their next project. The Board established and charged an AMSAT-NA Project Committee with the responsibility of coming up with a proposal for the next AMSAT satellite. The composition of this committee is a Who's Who in the Amateur Satellite community and includes: Bill Burden WB1BRE (AMSAT-NA Vice President for Strategic Planning); Ed Collins N8NUY (Special Assistant to the AMSAT-NA President); John Conner NJØC (Ground support); Art Feller W4ART (AMSAT-NA Treasurer); Bdale Garbee KBØG (Satellite software and digital designer, including participation

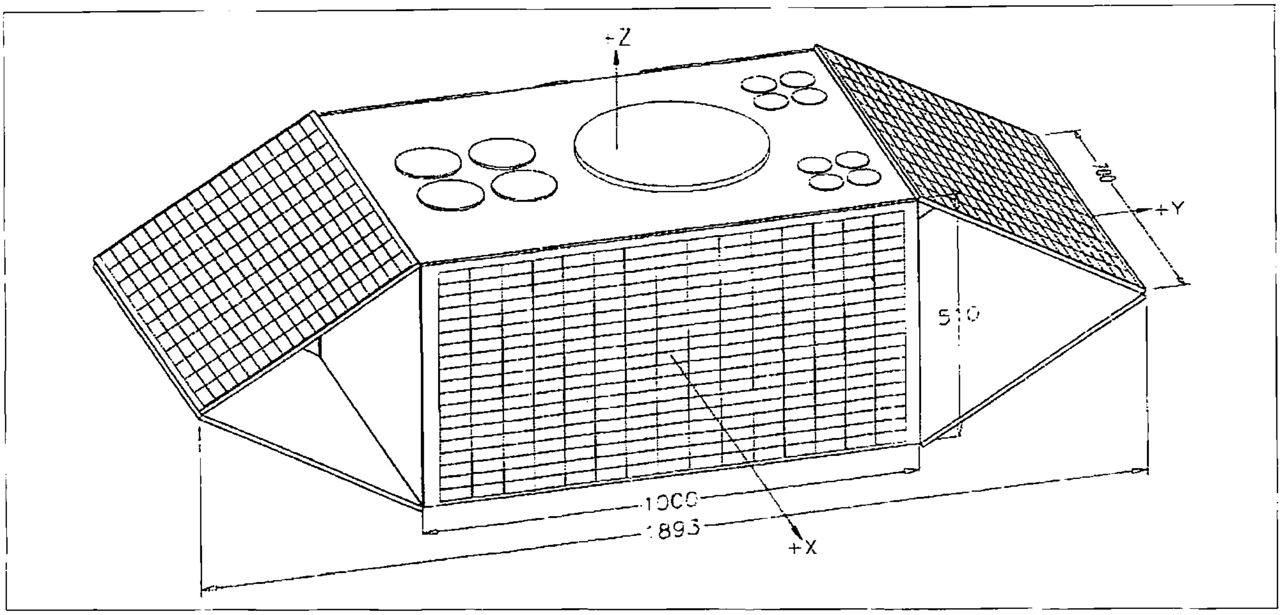

Fig. 1. Two amateur satellite proposals were considered at the AMSAT-NA Project Committee Denver workshop. While these satellites varied in physical design, they are functionally identical. Fig. 1 shows a diagram of the mechanical design proposal for an orbit-plan spin axis satellite that was developed and proposed by Dick Jansson WD4FAB. This proposed satellite is designed for launch into a geostationary-transfer orbit as a tertiary payload on an Ariane 5 launcher.

in Phase 3D RUDAK); Chuck Green NØADI (Designer and integrator of numerous Phase 3D modules and launch campaign deputy director); Robin Haighton VE3FRH (AMSAT-NA President and Board of Directors member); Rick Hamby W2GPS (Digital software data communications); Dick Jannson WD4FAB (Phase 3D structural and thermal designer); Lyle Johnson KK7P (Space flight computer designer); Mark Kanawati N4TPY (Satellite design and integration); Phil Karn KA9Q (Internet protocol); Jan King W3GEY (Founding AMSAT member and builder of numerous amateur radio satellites); Michael Kingery KE4AZN (Mechanical designer); Lou McFadin W5DID (Phase 3D Integration Laboratory Manager; Stacey Mills W4SM (AO-40 Command Station); Jim Sanford WB4GCS (Digital communications); Dan Schultz N8FGV (Satellite operations); Ray Soifer W2RS (International coordination); Brian Straup N5YC (Ground station development); Tomas Svitek (Systems engineering and launch); Russ Tillman K5NRK (Technology transfer/fund raising); Paul Williamson KB5MU (Software systems and electronic information); Jim White WDØE (Systems engineering, software design, and command station); and Stan Wood WA4NFY (AMSAT-NA Vice President of Engineering and Phase 3D antenna designer).

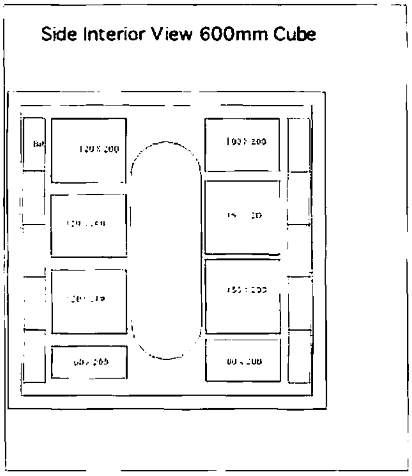

Fig. 2. A mechanical design proposal for a Y-spin satellite was presented by Stan Wood WA4NFY at the Denver workshop. The cube-design of this satellite could be launched on the Ariane 5 as a tertiary payload or via other launch vehicles.

Two very interesting satellite project proposals emerged from this committee (see **Figs. 1** and **2**). Both of these credible proposals were well thought out and addressed numerous difficult engineering and design challenges that would allow them to accomplish their respective missions. The challenge was for the Project Committee to consider the merits of each proposal and then agree to undertake a project that was technically feasible, followed sound engineering principles, and was in the best interest of AMSAT. Also, the recommended project would require the final approval of the AMSAT-NA Board of Directors and, more importantly, the continued support of the total AMSAT membership as expressed in both financial contributions and willingness to work on the project. To accomplish this task, the AMSAT-NA Project Committee held a weekend-long workshop in Denver, CO, in July 2001, where they attempted to resolve these difficult issues.

The Denver Workshop challenge: defining the design considerations of a radio amateur satellite

Physical and Mission Considerations: Various types of design considerations must be met when building an amateur radio satellite. Unfortunately, depending on what you want your satellite to do, some of these considerations may not be compatible with each other (while other considerations may be very supportive of one another). As a result,

design consideration interactions must be understood and address ways that support the mission of the satellite. (In fact, because of their complex intricacies, the impact that some relationships have on a satellite's mission may never be completely understood until after launch!) For example, a satellite experiences numerous physical conditions that may be functions unique to its orbit and the spacecraft's attitude in relationship to the earth and sun. As a result of these characteristics, thermal dynamic issues may arise that must be understood and addressed in the design of the satellite. As these issues are addressed, they may impact the satellite's ability to accomplish its primary mission — in this case, effective amateur radio communications and other related fun. As a result, design trade-offs on power reduction may have to be made in order to satisfactorily meet physical considerations such as temperature issues. Other times, very innovative solutions may emerge that can be applied to satisfactorily address both physical and mission considerations (i.e. win-win situations). Science rapidly becomes an art when exploring and resolving these design stage issues.

Technical and User Considerations: The first amateur radio satellites were built in small workshops and designed, constructed, tested, and launched in a relatively short period of time. Compared to today's amateur radio satellites, these early satellites were very inexpensive — built by two or three people — and did not even require modest financial contributions from the amateur radio community. They were also not as technically complicated as today's satellites. Over the past few years, universities and foreign governments have emerged as new and welcomed builders of amateur radio satellites. Within the ham community, every satellite that is launched by these new participants is openly welcomed as an exciting new venture and opportunity. As a result of these new participants, there has been a significant increase in the number of available analog and digital amateur satellites, allowing satellite operators to become accustomed to using several now-common operating frequency modes such as modes A, B, and J. While the majority of all satellite users have equipment in their shack (and now on their belts via HTs and Arrow Antennas) to work these more common mode satellites, other frequency modes have been identified and proposed that offer the potential to expand satellite design capabilities and enhance efficiencies of satellite and ground operations. (For discussions on some of these innovative modes, read James Miller G3RUH's article in this issue titled "A Modest Proposal.") As a result, a key challenge facing AMSAT is to get the membership to support using and experimenting with other modes when most are comfortable with the status quo. Because of existing equipment investments and current knowledge, this can become a heated and sensitive debate. However, this challenge is not something new, as AMSAT faced this dilemma many times when satellites employing new frequencies and associated technologies advanced from Mode A to Modes B, J, L, and S. As a partial solution to this dilemma (and perhaps a stress reliever), most university and foreign government amateur satellite builders are developing Mode J and B satellites that operate using existing technology. As a result, these satellites meet a large portion of membership demand. This also allows AMSAT some room to pursue other modes such as Mode L/S. (And — who knows? — perhaps by AMSAT pushing the design envelope, one day Mode L/S will be a common or standard mode among users.)

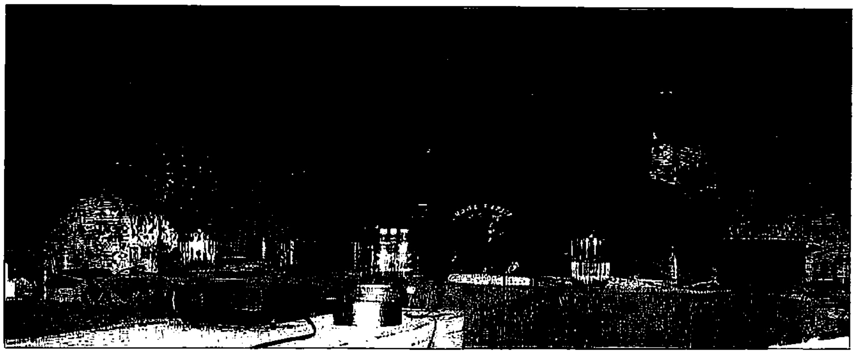

Photo A. Members of the AMSAT-NA Project Committee in attendance at a workshop in Denver, CO. From left to right (with area of expertise in parentheses): Russ Tillman K5NRK (Technology Transfer); Jim White WDØE (Systems Engineer, Software Design, and Command Station); Chuck Green NØADI (Design and Integration & Workshop Moderator); Lou McFadin W5DID (Design and Integration); Stan Wood WA4NFY (Design, Integration, and Antennas); Ed Collins N8NUY (Special Assistant to the President); Michael Kingery KE4AZN (Mechanical Design); Dan Schultz N8FGV (Operations); Paul Williamson KB5MU (Software Systems and Electronic Publications); Lyle Johnson KK7P (Spacecraft Flight Computer Design); Tomas Svitek (Guest by invitation of Jan King); Bdale Garbee KBØG (Software and Digital Design); Rick Hamby, W2GPS (Digital Software Data Communications); Dick Jansson WD4FAB (Mechanical and Thermal Design); John Conner NJØC (Ground Support); Phil Karn KA9Q (Internet Protocol); Robin Haighton VE3FRH (President & Board of Directors); Brian Straup N5YC (Ground Station); Mark Kanawati N4TPY (Satellite Design and Integration); Arthur Feller W4ART (Treasurer). (Photo by Mark Kanawati N4TPY)

Designer Considerations: Designers and builders of amateur satellites enjoy a technical challenge. That is, few if any want to rebuild an existing satellite, as designs can always be improved. While there are certainly lots of reasons why folks donate their time to build satellites, most enjoy the challenge of improving the design, pushing the envelope, or just doing something entirely new and innovative. As a result, a dilemma exists between the designers and users; the designers want to construct something new or better, while most users seem content happily using the existing satellite technology — they just want more of them. As mentioned earlier, the fortunate increase of amateur satellite suppliers

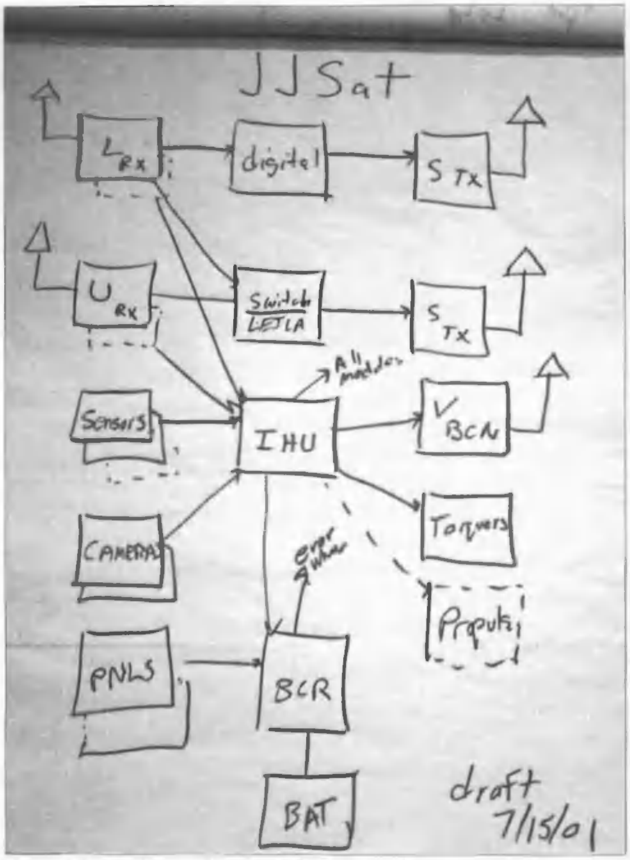

Photo B. In the tradition of designing the next satellite on the back of a cocktail napkin, workshop members used an easel scratchpad to identify the next satellite's components and their associated relationship. (Photo by Mark Kanawati N4TPY)

and associated available launches allows some of the existing demand to be met. As a result, this allows a bit of wiggle room for experimentation in new designs, technology, and operating modes that may become tomorrow's common operating modes.

The Final Consideration: Given the above considerations, the challenge is to identify and clearly understand all design considerations, stir them all together and let them simmer, correctly address their impact, and come up with an achievable and realistic design that will challenge both the builders and users of the proposed satellite. Nearly all of the time that is easier said than done, but that is probably one of the main challenges that makes hams want to build or use amateur radio satellites. Also, because design considerations often conflict, it is a tough, and perhaps impossible task to design the perfect amateur radio satellite. While it is a noble goal to build the perfect satellite, in reality, compromises or trade-offs amongst design considerations have to be made in order to accomplish the mission. And, to top it off, this all accumulates with the significant risk associated with placing your carefully designed and built satellite on top of a rocket in hopes that you achieve a successful launch. However (thankfully?), builders, sponsors, and users all have very little control over a launch. Add all the components of this process up and you have a very risky business that is accomplished entirely with members' donated time and dollars! However, the results continue to be stunning; just look at the number of amateur radio satellites in orbit!

So what's the bottom line? What is AMSAT's next satellite project?

So, given all of these design considerations, what did the Project Committee do at their Denver workshop? In a nutshell, the committee did what past AMSAT designers and builders of satellites did; they got down in the technical weeds and forged a satellite design that would accomplish a specific mission, be technically challenging, meet membership needs, and be worthy of financial support. Is the design of this workshop perfect and complete? Certainly not. There were compromises, and components of this proposed design will continue to evolve and be improved up until the day of the launch. However, that is the nature and reality of the satellite design business; all of the answers are not on the table upfront. As a result, continual improvements are always being made to enhance the mission.

The key points of the proposed satellite design that was forged at the Denver Workshop are best summarized by portions of an open letter that AMSAT-NA President Robin Haighton VE3FRH, provided AMSAT-NA members after the workshop:

Greetings:

It is with great pleasure that I write to you this month and talk about the progress being made with our next satellite project, currently known as "Project JJ." [Tentatively named for Dick Jansson WD4FAB and Lyle Johnson KK7P, who proposed the two initial satellite designs (**Figs. 1** and **2**) that were the basis for further discussion and analysis at the workshop.]

Recently, a meeting was held in Denver, Colorado — attended by twenty of AMSAT-NA's designers and officers. Their main objective was to begin implementation of this project, as mandated by the AMSAT-NA Board of Directors. While it is not my intention in this letter to go into every detail about the meeting, it is important to note that one very significant decision made was to make every aspect of this new satellite (as it is being designed) completely available to the AMSAT community. By every aspect I mean every drawing (including schematics), every piece of code, and all telemetry details, etc. The only details that will not be released are those that would possibly endanger the security of the spacecraft when in orbit (should hackers become active on the bird), and any proprietary commercial data (which I don't think that there will be much, if any, of). In other words, Project JJ will be your satellite!

Yes, this new project will be an "open concept" design and the project committee will welcome your constructive feedback as the project progresses. In fact, I am pleased to announce that Paul Williamson KB5MU will be posting project information on the AMSAT-NA WWW page and Russ Tillman K5NRK will be writing an initial article for *The AMSAT-NA Journal*

— with more articles planned as we progress. I am also pleased to announce that Lyle Johnson KK7P and Chuck Green NØADI have agreed to act as joint managers at the start of this project.

As with any project it is always wise to review, and learn from, previous projects. Accordingly, at the Denver meeting a review of the Phase 3 series of satellites was undertaken. Discussion took place on advantages and disadvantages, things we want to repeat and things we can improve on. Such a review is a very valuable part of the design process.

Some of the decisions made at the meeting included:

- Sideband uplinks on L- and U-bands with an S-band downlink;
- Digital communications (TDMA) L-band uplink with S-band downlink;
- V-band telemetry beacon;
- Gain antennas for U-, L-, and S-bands;
- Omnidirectional antennas (for initial commands in the lower part of the orbit);
- Propulsion system only if absolutely necessary. This is a function of yet-undetermined launch dynamics and we may require some form of simple system for perigee adjustment. A decision on this will be made on the need of a propulsion system in the near future.

Now to the important question of finance. It is quite apparent that the days of inexpensive launches are over, especially if we want a good, reliable launch, which I'm sure we all do. Therefore, it is imperative that we immediately commence a fund-raising effort — for a launch (currently estimated) in early 2004.

Again, this will be your satellite!

73,

Robin Haighton VE3FRH

President, AMSAT-NA

At the workshop, an overall decision was also made to proceed with spacecraft design (module sizes — volume and mass, electrical connectors and interfaces, module identification, preliminary power budget, specifications for each identified module) and have this ready for a preliminary design review by the end of 2001. A critical design review will follow the preliminary design review a few months later. Every module will require a detailed test plan as part of its design. To expedite this process, Lyle Johnson KK7P and Chuck Green NØADI agreed to co-manage the project to bring it to this point.

By the end of 2001, Robin Haighton VE3FRH (working with Jan King W3GEY and others) will identify a launch opportunity. Meanwhile, Shep Shepard AA7MH will oversee an AMSAT-NA Business Development Committee to decide what funding can realistically be raised for the project.

It is proposed that the new satellite will then be built, tested, and integrated during 2002. It was also proposed that all modules will be tested individually and then tested as part of and after integration during 2003. The shipment of the satellite to (a presently undetermined) launch agency can occur by the end of 2003, with a potential launch as early as the first part of 2004.

At the Denver Workshop, the following responsibilities were assigned:

Mechanical (launch-dependent decisions): Dick Jansson WD4FAB, Lyle Johnson KK7P, Stan Wood WA4FNY, and Chuck Green NØADI.

Mechanical (designs, drawings, etc.): Dick Jansson WD4FAB and Mike Kingery KE4AZN.

Antennas: Stan Wood WA4NFY.

Thermal Design: Dick Jansson WD4FAB.

Digital Communications: Phil Karn KA9Q.

Digital Ground Hardware: Brian Straup N5YC.

Computers & Related Sensors: Lyle Johnson KK7P.

Navigation Sensors: Lou McFadin W5DID.

Propulsion (launch-dependent): Tomas Svitek.

Command Team Leader: Stacey Mills W4SM.

Power System: John Conner NJØC.

Launch Availability: Robin Haighton VE3FRH, Jan King W3GEY, and Tomas Svitek.

Continued on page 62

Robin Haighton VE3FRH
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AMSAT, Where to Next?

The prez tells us.

Since amateur radio's conception, its experimenters have frequently led the way in innovation and new ideas for the Amateur Radio community as well as for both civilian and military users. AMSAT is certainly no stranger to this concept, having led the way for microsat usage, assisted launch agencies with the design and implementation of secondary payload rings as well as search and rescue ideas, and come up with many other innovations.

The future of AMSAT depends, to a great degree, on the continued ability of the AMSAT technical designers and engineers to devise new techniques and to inspire the membership to continue to experiment with science in space. This in turn depends on the willingness of the membership to support the AMSAT activities.

Amateur Radio enthusiasts are, by their very nature, people who are interested in the science of radio and communications. Many of us have been fascinated with radio since our earliest days and have experimented with devices such as crystal sets, tubes, transistors, and integrated circuits even before we could understand their function. We are often the "early users" when new devices hit the marketplace and are always on the lookout for that new device or item at the ham flea market. This is particularly true of those who work the amateur satellites, and we are anxious to try out the "new bird" with its latest bands, new devices, and unique functions. AMSAT, comprising many national and individual AMSAT organizations and a worldwide membership, has been a leading proponent of space communications and experimentation. The results of this effort by thousands of satellite operators have benefited communications and science experiments in commercial, military, and amateur satellites. Since the early days of OSCAR 1 in 1961, forty-two satellites have achieved the designation of OSCAR (Orbiting Satellite Carrying Amateur Radio), and more are anticipated this year. Many of these satellites have had unique experiments on board which proved a new design or technique. Often by the life of the satellite we are able to evaluate the effectiveness, in space, of a material or radiation-hardened electronic components. The success of the satellite programs has been such that several major manufacturers are producing transceivers which are directly usable in the satellite service as well as in the HF service, and include CAT ports for Doppler frequency correction, as well as the capability to track both forward and reverse between the frequency bands, with full duplex communication.

With all this said, there are several questions that keep being asked, and they are very important, because they affect the investment that you have made or are going to make in equipment and support of your local AMSAT.

Qnestion 1: "With all the new ideas and innovations that I hear about, will my existing equipment be of any use?"

Answer: Yes — definitely — yes! Although new ideas will be tried and developed, existing systems using your current equipment will be around for many years to come. For example, the next satellite built in AMSAT-NA will have standard SSB capability as well as a new digital modulation system. It is also most likely to have a 70cm uplink and a 2-meter downlink (Mode B) as well as higher frequencies.

Question 2: "SSB has been with us for over 50 years — should we be looking at newer and more efficient modulation techniques?"

Answer: Yes, on the new AMSAT-NA satellite, it is proposed to have a digital modulation system which could eventually replace SSB as our main modulation system, particularly in satellite work. The digital system would be more efficient with power, and more accurate with communications, resulting in less AM interference. Built-in Forward Error Correction

(FEC) would provide greater reliability. However, while such systems are readily available on your digital cell phone, they have not been applied to amateur satellites — yet!

Question 3: "OK, so we know what AMSAT-NA proposes, but who is doing any thing else?

Answer: There are many satellite programs applicable to Amateur Radio being constructed for launch at the present time (late August). These include:

• AMSAT-CE CESAR-1, a microsat 2m, 23cm uplink and 70cm, 13cm down. Possibly to be launched in 2001.

• AMSAT-VU, 2M and 70 Cm. Details being discussed.

• AMSAT-DL, an amateur radio mission to the planet Mars providing telemetry to radio amateurs on amateur bands as described briefly at the AMSAT-UK colloquium July 2001. (Details in the *AMSAT-DL Journal* in German).

• PCSAT by Bob Bruninga WB4ARP, an APRS satellite — due to have launched in September 2001.

• Starshine by Gil Moore N7YTK, an educational satellite — due to have launched in September 2001.

• Many Cubesats, comprising 4-inch cubes to be launched late in 2001 or early in 2002. These are educational satellites in the amateur satellite bands.

These listed satellites should be fully available to the ham community, and will use technology which is applicable to existing equipment in the 2-meter and 70cm bands.

So what is the long-range plan for AMSAT-NA? Our current thinking is that as amateur radio hobbyists we will continue to design, build, and operate satellites, while developing new ideas and leading technology. We believe that by advancing the state of the art while still maintaining the opportunity to use existing equipment, we will increase our new membership and continue to satisfy those existing members who enjoy the more traditional means of communication through satellites.

We are therefore proposing to have a new satellite launched into orbit about every 3 to 4 years as adequate funding becomes available. Each one in turn will have some advancement, but there will be some of the traditional operating means available on some of the satellites. All of this takes funding, chiefly provided by the Amateur Radio Satellite community. So let me ask the next and last questions:

Is the amateur satellite community prepared to support the principles that I have laid out above? Are you willing to join your national or international AMSAT organization? Are you prepared to financially contribute and/or be an active participant in the organization?

Don't leave it to others — do it now!

Microwave Antennas for AO-40

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had fun in the process. I hope this taster of an article will encourage you to have a go and build your own AO-40 antenna array.

Good luck, and see you on AO-40!

Further reading and resources

AMSAT — [http://www.amsat.org]

AMSAT DL — [http://www.amsat-dl.org]

AMSAT UK — [http://www.amsat-uk.org]

ARRL — [http://www.arrl.org]

G3PHO — [http://www.g3pho.free-online.co.uk]

G3RUH — [http://www.jrmiller.demon.co.uk]

G6LVB — [http://www.g6lvb.com]

RSGB — [http://www.rsgb.org.uk]

Modifying the TranSystem 3733 for Mode S

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I'm not that worried about what numbers appear on the display of the radio.

There are some other mods being performed on the unit. I have not had a need for these, but they may fit your needs. Several people have added a thermistor to the crystal to act as an oven. You can see this mod at [http://members.aol.com/k5gna/PTCthermistor.jpg]. Another mod is to remove and/or replace the first-stage filter. This should provide even better performance, but it is not an operation for the faint of heart. It is very easy to damage the front end of the downconverter with static, and optimizing this filter requires some fancy test gear. Adapters are available to replace the integrated antenna with a type "N" connector. This would allow for experimenting with other antennas. Jerry K5OE has a mod to power a preamp ahead of the unit. You can see it at [http://home.swbell.net/k5oe/3733_12Vdc.jpg].

I would like to close this article with a few comments on operating with the 3373. The unit will drift in frequency a bit. It is best to power it up an hour or two before you intend to use it. Remember, it was designed to run 24 hours a day 7 days a week, so there is nothing wrong with leaving it on. The integrated dish reflector with the stock integrated dipole is easy to set up and hard to beat. You can see mine in **Photo F**. Several people have reported that their units survived very short accidental transmissions. That's good to hear, but take care and try not to transmit into the unit. If I have a complaint, it is that the downconverter has too much gain. I have 10 dB of attenuation between my power inserter and my radio. The bottom line is that Mode S is easy and fun! I hope to work you soon on AO-40!

All Aboard for ARISS ...

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ISS to begin using the ham radio station.

Conclusion

The year 2001 will long be remembered as the year that the ARISS team pioneered a new facet of amateur radio — permanence on the International Space Station. In the future, there will be new equipment, new modes of operation, and exciting QSOs. Enjoy the QSOs, experimentation, and school group contacts. And remember the international team that made it happen — ARISS.

Continued on page 61

Propagation

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Erratic

Conditions throughout November will be erratic as sunspot numbers remain high and solar activity fluctuates from low to moderate levels. Numerous minor flares and recurring coronal holes will continue to plague operators through increased signal absorption, auroral echo, and shortwave fadeouts.

Tropical storms will also add their share of atmospheric noise to the higher bands, but on the whole this month should be one of the better ones for DXers this year. I've picked 15 days as Good (G) or Fair-to-Good (FG), so everyone should have a shot at making some interesting long distance contacts.

Although no Poor (P) days appear on the calendar, you can still expect ionospheric or geomagnetic disturbances to occur during about one-third of the days at lower latitudes and almost one-half the days at more northerly locations. Those days I've earmarked as Fair-to-Poor have the greatest potential for troublesome events to materialize on the sun.

Events such as Coronal Mass Ejections (CMEs), disappearing filaments, and major flares, can have two effects on communications: immediate and delayed. Immediate effects, termed Sudden Ionospheric Disturbances (SIDs), occur within 8 to 10 minutes and can cause moderate to severe fading or total blackouts lasting up to several hours. Delayed effects arrive within 24 to 48 hours in the form of geomagnetic storms that can disrupt communications for up to several days. These delayed storms are not reflected on my calendar due to their less predictable nature, so keep this in mind when wondering why the conditions do not match the forecast.

Next time, I will expand on this theme of forecast vs. actual conditions by explaining some of the methods and pitfalls of long-range forecasting. Until then, Happy Thanksgiving!

Band-by-Band Summary

10–12 Meters

Good to excellent propagation conditions can be expected on Good (G) days starting shortly after sunrise and continuing up to

November 2001						
SUN	MON	TUE	WED	THU	FRI	SAT
				1 F-P	2 F	3 F
4 F-G	5 F-G	6 F-G	7 F-P	8 F-P	9 F	10 F-P
11 F-P	12 F-G	13 F-P	14 F-P	15 F-G	16 G	17 F-G
18 F-P	19 F-G	20 G	21 G	22 F-P	23 F-P	24 F-G
25 G	26 F-G	27 F-P	28 F-P	29 F-G	30 F-G	

EASTERN UNITED STATES TO:												
Central America	15/17	17/20	17/20	17/20	17/20	15/17	15/17	10/12	10/12	10/12	17/20	10/12
South America	15/17	15/17	20	30/40	30/40			10/12			12/15	12/15
Western Europe	30/40	30/40	17/20	17/20				10/12	10/12	12/15	17/20	17/20
South Africa	20/30	40	20/30	20/30					10/12	10/12	12/15	12/15
Eastern Europe	17/20	30/40	40/80	40/80	30/40			15/17	10/12	15/17	15/17	17/20
Middle East	20	20	20						10/12	10/17	15/17	15/20
India/ Pakistan	17/20	17/20						15/17				
Far East/ Japan	10/12		17/20				17/20	17/20			15/17	10/12
Southeast Asia	15/17		17/20	17/20			17/20	15/17	10/12			15/17
Australia	10/12	17/20	20	20	20	30/40	30/40	17/20				10/12
Alaska	10/12		20				17/20	20			15/17	10/12
Hawaii	10/12	12/15	17/20	17/20	20/30	20/30	17/20	17/20				10/12
Western USA	20/30	20/30	20/30	30/40	30/40			10/12	10/12	10/12	15/17	17/20
CENTRAL UNITED STATES TO:												
Central America	15/17	15/17	17/20	17/20	20/30			10/12	15/17	10/12	10/12	10/12
South America	15/17	15/17	20/30	20/30	17/20			10/12			10/12	12/15
Western Europe								12/15	12/15	12/15	17/20	17/20
South Africa			17/20	17/20					12/15	12/15	15/17	17/20
Eastern Europe	30/40	30/40	30/40						12/15	12/15	17/20	17/20
Middle East	20	20							15/17	15/17	15/17	
India/ Pakistan	15/17	17/20						12/15	12/15			
Far East/ Japan	10/12	12/15	17/20	17/20	17/20		17/20	17/20				10/12
Southeast Asia	10/12		15/20	17/20					10/12	10/12		
Australia	10/12	15/17	15/17		17/20	20/30	30/40	17/20			12/15	10/12
Alaska	10/12	12/15	17/20	17/20	20		17/20	17/20				10/12
Hawaii	12/15	15/17	15/17	17/20	17/20	20/30	30/40	17/20		10/12	12/15	12/15
WESTERN UNITED STATES TO:												
Central America	10/12	12/15	15/17	17/20	30/40				10/12	10/12	10/12	12/15
South America	10/12	12/15	15/17	17/20	17/20						10/12	10/12
Western Europe	17/20				17/20			17/20	17/20	20	20	20
South Africa	17/20	20		20						10/12	12/15	12/15
Eastern Europe	17/20	17/20							15/17	15/17	17/20	17/20
Middle East	20									15/17	15/17	20
India/ Pakistan		15/17	17/20						12/15	15/17		
Far East/ Japan	10/12	10/12	12/15	17/20	17/20	17/20			17/20			15/17
Southeast Asia	10/12	10/12						17/20	15/17	17/20		
Australia	10/12	12/15	15/17	15/17	17/20	17/20	17/20		17/20			
Alaska	10/12	10/12	15/17	17/20	17/20	17/20		17/20	17/20			15/17
Hawaii	10/12	10/12	12/15	15/17	20/30	20/30	30/40		12/15	10/12		
Eastern USA	20/30	20/30	30/40	30/40	30/40			10/12	12/15	12/15	15/17	17/20

Table 1. Band, time, country chart. Plain numerals indicate bands which should be workable on Fair to Good (F-G) and Good (G) days. Numbers in parentheses indicate bands usually workable on Good (G) days only. Dual numbers indicate that the intervening bands should also be usable. When one number appears in parentheses, that end of the range will probably be open on Good (G) days only.

two hours past sunset. Work toward Europe and Africa before noon, Central and South America from late morning to mid-afternoon, and the Pacific, Australia, and Southwest Asia in the late afternoon or early evening. Short-skip will vary between 1,000 and 2,000 miles on most days.

15–17 Meters

Good to Excellent daytime openings will be workable on Good (G) days. As always, follow the progress of the sun by working to the east in the morning, to the south around midday, and to the west in the afternoon through mid-evening. Look for especially long paths to the southern hemisphere with short-skip effective between 800 and 2,100 miles.

20 Meters

Good to excellent daytime propagation and Fair to Good nighttime conditions will allow around-the-clock activity. In general, work toward the east in the morning, the south at midday, and the west in the afternoon and evening. Be sure to check the Time-Band-Country Chart for additional openings, notably the Middle East and Africa in the afternoon. Short-skip will vary between 1,000 and 2,200 miles.

30–40 Meters

Good to excellent propagation conditions may exist on Good (G) days provided that atmospheric static is low. The best opportunities will occur during the hours of darkness, but early mornings and late afternoons can also be fruitful. Work toward the east and southeast before midnight and to the west, northwest, and southwest between midnight and sunrise. Short-skip at night will average between 500 and 2,000 miles, while during the day it is limited to under 1,000 miles.

80–160 Meters

Fair conditions can be expected on Good (G) days with atmospheric noise due to storms being the primary limitation. Grayline propagation during the morning and evening twilight hours will provide the best long distance opportunities with a short-skip distance of up to 2,000 miles. In general, work to the east and southeast before midnight, and to the southwest through northwest after midnight. If 40 meters is open, 80 and 160 could he, too.

All Aboard for ARISS ...

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For more information on the ARISS program, you are welcome to surf the ARISS Web page at: [http://ariss.gsfc.nasa.gov].

Hamsats Awards

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Intermediate Level (includes contacts from Beginner Level)

Work 2 School Club Stations

Work 8 YL Ops

Work 8 Young Ops (16 and younger)

Work 15 Ops that have had their license for less than 2 years at the time of contact

Work 2 Ops as their "1st Satellite Contact" (ever, not just on a particular satellite)

Expert Level (includes contacts from Intermediate Levels)

Work 3 School Club Stations

Work 12 YL Ops

Work 15 Young Ops (16 and younger)

Work 25 Ops that have had their license for less than 2 years at the time of contact

Work 4 Ops as their "1st Satellite Contact" (ever, not just on a particular satellite)

Any satellite may be used for these contacts, but contacts must be made by voice or CW. No packet contacts allowed. Contacts with the ISS, shuttle, or any other manned spacecraft are not to be used for this award.

Contacts must be made on or after November 1, 2001.

Callsigns may be used only once. Therefore, if a callsign fits multiple categories, it is your choice as to which category you claim it for (e.g., Mahana W5BTS, could be claimed for YL op, Young Op, and Op licensed less than 2 years). School Club callsigns count only towards the School Club category.

No QSL cards are required, however,

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Hamsats Awards

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random checks with the operators listed will be performed.

To submit for the award, send a list in date/time order with Callsign/Date of Contact/Time of Contact/Satellite/ Category to the AMSAT Awards Manager, KK5DO.

For category please use:

YL for YL ops contact

Teen for Young ops

First for 1st Contact

New for ops less than 2 years

School for School Club Station

For sample submittal, see **Table 1**.

A certificate is available for $3.50 for AMSAT members and $5 for non-AMSAT members. Two units of postage are required for return of your certificate.

Various magazines, countries and ham groups have other awards. There is even one from Russia, the Cosmos Award. So you may have to check around to find them. Should you have any questions about any of the AMSAT or ARRL awards, I would be happy to answer them. Please send them to me via snail-mail or the preferred method, E-mail, at [kk5do@ amsat.org].

73, and good luck in chasing your favorite award!

Risky Business

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Cameras — Lens: Lou McFadin W5DID.

Cameras — Detector: Lyle Johnson KK7P.

Regulatory: Dick Daniels W4PUJ.

Magnetorquors: Lou McFadin W5DID.

Chief Information Officer (Electronic): Paul Williamson KB5MU.

Project Co-Managers (until launch details have been decided): Lyle Johnson KK7P and Chuck Green NØADI.

The real challenge: What can *you* do?

Lots of good things came out of the Denver Workshop. The next AMSAT satellite has a proposed design and direction. In addition, preliminary time lines for constructing and testing the satellite have been identified, along with assignments for responsibility of developing a variety of satellite modules. An innovative and simple-design digital operating mode has been proposed to fly on the satellite that will allow more hams to access the satellite via low-cost satellite ground stations.

Lots of challenges also came out of the Denver Workshop. With this ambitious project comes a hefty price tag; it will be a challenge for AMSAT to raise the necessary funds. Also, the need for new builders, ground station hardware designers, and command and control stations to come forward and help with this task was apparent. There will be plenty of opportunities for interested hams to work on this project. One benefit of the proposed open design concept is that it will enhance members' awareness of ongoing developments. As a result, more opportunities will exist for locating and employing much-needed assistance during the development and testing of the satellite.

As AMSAT-NA's next satellite project matures, there will be many opportunities for involvement and participation. So, if you are interested in participating in the next AMSAT satellite project, the first step is easy: Stay abreast of developments of this project. It does not matter where you live in this world, as AMSAT communicates via E-mail, WWW, fax, telephone, and (you guessed it) amateur radio. There are several first steps you can do to Support this project, namely:

• Join AMSAT-NA! Membership and financial support should be your first step in participating in this project. Among many benefits, AMSAT members receive *The AMSAT Journal*, which continually chronicles the development and use of many amateur satellites.

• For the latest developments, monitor [http://www.amsat.org] and weekly AMSAT News Service bulletins.

• Subscribe and participate in discussions on amsat-bb, an E-mail list that openly discusses a variety of evolving amateur satellite issues. (Complete subscription details are available via [http://www.amsat.org].)

• Get on the air and use the satellites! It is a great way to understand existing and emerging technology. It's a great way to learn, lots of fun, and you will enjoy the comradeship!

As calls for help or assistance arise during this project, they will be posted via the above sources. So, get prepared to jump in and have fun!

Russ Tillman K5NRK *has been editor of* The AMSAT Journal *for six years. He's a member of the AMSAT's Project and Business Development committees and Vice President of Publications. When not doing AMSAT business, he enjoys pursuing DX whether via satellites, HF, E-mail, or eyeball-to-eyeball.*

QRX

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"As part of the worldwide amateur radio community, Australian amateurs have many friends and relatives in the U.S., and many of us are wondering how these friends are faring.

"I note with pride, however, that in this as in many other such situations, amateurs have already offered their services through the ARRL and its various emergency service organizations to provide assistance to both individuals and the wider community affected by this disaster. This spirit is especially significant in this the International Year of the Volunteer.

Our thoughts and best wishes go out to all American amateurs involved in the valiant rescue efforts currently underway. I feel sure that all amateurs in Australia will be watching the developments in the U.S. carefully over the next few days and many of us wish that we were better placed to provide assistance to those in need at this time."

Shortly after the terrorist attacks on the World Trade Center and the Pentagon, FCC Special Counsel Riley Hollingsworth asked radio amateurs to keep their ears open and report any suspicious or clandestine communications to him.

If you do happen across something that needs to be reported, you will need to know where to take your information. Those who have been watching TV or reading newspapers already know that a Federal Bureau of Investigation task force is assigned to head up the domestic aspect of the investigation. It has also requested all media outlets let the public know that it would like any leads reported directly to it. To accomplish this, the FBI has set up a toll-free number area code (866) 483-5137. Information can also be sent via a special Web site at [www.ifccfbi. gov]. The FCC's Hollingsworth can be contacted by E-mail to [fccham@fcc.gov]. All these addresses and other resources are at the very top of the Amateur Radio Newsline Web page at [www.arnewsline.org].

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Wise Up!

Here are some of my books which can change your life (if you'll let 'em). If the idea of being healthy, wealthy and wise interests you, start reading. Yes, you can be all that, but only when you know the secrets which I've spent a lifetime uncovering.

......Wayne

The Secret Guide to Health: Yes, there really is a secret to regaining your health and adding 30 to 60 years of healthy living to your life. The answer is simple, but it means making some serious lifestyle changes. Will you be skiing the slopes of Aspen with me when you're 90 or doddering around a nursing home? Or pushing up daisies? No, I'm not selling any health products, but I can help you cure yourself of cancer, heart trouble, or any other illness. Get this new, 2001 expanded edition (156p). $10 (#05)

The Secret Guide to Wealth: Just as with health, you'll find that you have been brainwashed by "the system" into a pattern of life that will keep you from ever making much money and having the freedom to travel and do what you want. I explain how anyone can get a dream job with no college, no résumé, and even without any experience. I explain how you can get someone to happily pay you to learn what you need to know to start your own business. $5 (#03)

The Secret Guide to Wisdom: This is a review of around a hundred books that will boggle your mind and help you change your life. No. I don't sell these books. They're on a wide range of subjects and will help to make you a very interesting person. Wait'll you see some of the gems you've missed reading. You'll have plenty of fascinating stuff to talk about on the air. $5 (#02)

The Bioelectrifier Handbook: This explains how to build or buy ($155) a little electrical gadget that can help clean your blood of any virus, microbe, parasite, fungus or yeast. The process was discovered by scientists at the Albert Einstein College of Medicine, quickly patented, and hushed up. It's curing AIDS, hepatitis C, and a bunch of other serious illnesses. It's working miracles! The circuit can be built for under $20 from the instructions in the book. $10 (#01)

My WWII Submarine Adventures: Yes, I spent from 1943-1945 on a submarine, right in the middle of the war with Japan. We almost got sunk several times, and twice I was in the right place at the right time to save the boat. What's it really like to be depth charged? And what's the daily life aboard a submarine like? How about the Amelia Earhart inside story? If you're near Mobile, please visit the Drum. $5 (#10)

Wayne's Caribbean Adventures: My super budget travel stories – where I visit the hams and scuba dive most of the islands of the Caribbean. You'll love the special Liat fare which let me visit 11 countries in 21 days, diving all but one of the islands, Guadeloupe, where the hams kept me too busy with parties. $5 (#12)

Cold Fusion Overview: This is both a brief history of cold fusion, which I predict will be one of the largest industries in the world in the 21st century, plus a simple explanation of how and why it works. This new field is going to generate a whole new bunch of billionaires, just as the personal computer industry did. $5 (#20)

Cold Fusion Journal: They laughed when I predicted the PC industry growth in 1975. PCs are now the third largest industry in the world. The cold fusion ground floor is still wide open, but then that might mean giving up watching ball games. Sample: $10 (#22)

Julian Schwinger: A Nobel laureate's talk about cold fusion—confirming its validity. $2 (#24)

Dowsing. Yes, dowsing really does work. I explain how and why it works, opening a huge new area for scientific research with profound effects for humanity. $2 (#84)

Improving State Government: Here are 24 ways that state governments can cut expenses enormously, while providing far better service. I explain how any government bureau or department can be gotten to cut it's expenses by at least 50% in three years and do it cooperatively and enthusiastically. I explain how, by applying a new technology, the state can make it possible to provide all needed services without having to levy *any* taxes at all! Read the book, run for your legislature, and let's get busy making this country work like its founders wanted it to. Don't leave this for "someone else" to do. $5 (#30)

Mankind's Extinction Predictions: If any one of the experts who have written books predicting a soon-to-come catastrophe which will virtually wipe most of us out are right, we're in trouble. I explain the various disaster scenarios, like Nostradamus, who says the poles will soon shift (as they have several times in the past), wiping out 97% of mankind. Okay, so he's made a long string of past lucky guesses. The worst part of these predictions is the accuracy record of some of the experts – like Hapgood, Einstein, Snow, Noone, Felix, Strieber. $5 (#31)

Moondoggle: After reading René's book, *NASA Mooned America*, I read everything I could find on our Moon landings. I watched the NASA videos, looked carefully at the photos, read the astronaut's biographies, and talked with readers who worked for NASA. This book cites 45 good reasons I believe the whole Apollo program had to have been faked. $5 (#32)

Classical Music Guide: A list of 100 CDs which will provide you with an outstanding collection of the finest classical music ever written. This is what you need to help you reduce stress. Classical music also raises youngster's IQs, helps plants grow faster, and will make you healthier. Just wait'll you hear some of Gotschalk's fabulous music! $5 (#33)

The Radar Coverup: Is police radar dangerous? Ross Adey K6UI, a world authority, confirms the dangers of radio and magnetic fields, including our HTs and cell phones. $3 (#34)

Three Gatto Talks: A prize-winning teacher explains what's wrong with American schools and why our kids are not being educated. Why are Swedish youngsters, who start school at 7 years of age, leaving our kids in the dust? Our kids are intentionally being dumbed down by our school system — the least effective and most expensive in the world. $5 (#35)

Aspartame: a.k.a. NutraSweet, the stuff in diet drinks, etc., can cause all kinds of serious health problems. Multiple sclerosis, for one. Read all about it, two pamphlets for a buck. (#38)

$1 Million Sales Video: The secret of how you can generate an extra million dollars in sales just by using PR. This will be one of the best investments you or your business will ever make. $40 (#52)

Reprints of My Editorials from *73*. Very few things in this world are as we've been taught, and as they appear. I blow the whistle on the scams around us, such as the health care, our school system, our money, the drug war, a college education, sugar, the food giants, our unhealthy food, fluorides, EMFs, NutraSweet, etc.

1996 Editorials: 120 pages, 100 choice editorials. $10 (#72)

1997 Editorials: 148 fun-packed pages. 216 editorials. $10 (#74)

1998 Editorials: 168 pages that'll give you lots of controversial things to talk about on the air. $10 (#75)

1999 Editorials: 132 pages of ideas, book reviews, health, education, and anything else I think you ought to know about. $10 (#76)

2000 Editorials: 76 pages (thinner magazine as a result of our slowly dying hobby) $5 (#77)

Silver Wire: With two 5-in. pieces of heavy pure silver wire + three 9V batteries you can make a thousand dollars worth of silver colloid. What do you do with it? It does what the antibiotics do, but germs can't adapt to it. Use it to get rid of germs on food, for skin fungus, warts, and even to drink. Read some books on the uses of silver colloid, it's like magic. $15 (#80)

Silver Colloid Reprint. April 97 article on a silver colloid maker, history, and how to use the stuff. $5 (#98).

Colloid Kit. Three 9V battery clips, 2 aligator clips & instructions. $5 (#99).

Wayne's Bell Saver Kit. The cable and instructions enabling you to inexpensively tape Art Bell W6OBB's nightly 5-hr radio talk show. $5 (#83)

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Cold Fusion Six-Pack: Six Cold Fusion Journal back issues to bring you up to speed. $20 (#19)

NASA Mooned America: René makes an air-tight case that NASA faked the Moon landings. This book will convince even you. $30 (#90)

Last Skeptic of Science: This is René's book where he debunks a bunch of accepted scientific beliefs – such as the ice ages, the Earth being a magnet, the Moon causing the tides, etc. $30 (#91)

Dark Moon: 568 pages of carefully researched proof that the Apollo Moon landings were a hoax—a capping blow for René's skeptics. $35 (#92)

Dark Moon Video: 222-minute exposé nailing NASA with their own photos. If you've watched the NASA films of the astronauts walking on the Moon you wondered at their weird gait. Wait'll you see it speeded up. It looks exactly like they're running on Earth! They catch NASA in dozens of give-aways that the photos and films had to have been faked. $46 (#93)

1X

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The *73* Flea Market, Barter 'n' Buy, costs you peanuts (almost) — comes to 35 cents a word for individual (noncommercial!) ads and $1.00 a word for commercial ads. Don't plan on telling a long story. Use abbreviations, cram it in. But be honest. There are plenty of hams who love to fix things, so if it doesn't work, say so.
Make your list, count the words, including your call, address and phone number. Include a check or your credit card number and expiration. If you're placing a commercial ad, include an additional phone number, separate from your ad.
This is a monthly magazine, not a daily newspaper, so figure a couple months before the action starts; then be prepared. If you get too many calls, you priced it low. If you don't get many calls, too high.
So get busy. Blow the dust off, check everything out, make sure it still works right and maybe you can help make a ham newcomer or retired old timer happy with that rig you're not using now. Or you might get busy on your computer and put together a list of small gear/parts to send to those interested?

Send your ads and payment to: *73 Magazine*, Barter 'n' Buy, 70 Hancock Rd., Peterborough NH 03458 and get set for the phone calls. The deadline for the January 2001 classified ad section is November 10, 2001.

QRX

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Thanks to Henry Feinberg K2SSQ, the ARRL, WB3GXW, the FBI, CGC Communicator, Radio World, *Andy Jarema N6TCQ, and* Q-News, *all via* Newsline, *Bill Pasternak WA6ITF, editor.*

During this time of crisis and particularly of national giving and thanksgiving, *73* would like to urge our readers to consider using the *Newsline* Web site to make a donation to *Newsline*, surely one of amateur radio's great unsung assets — in peacetime and otherwise.

Never Say Die

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his lawyers don't want to be bothered, but I bet Steve will.

Now, if you'll send a letter to Steve Jobs, Apple, 1 Infinite Loop, Cupertino CA 95014, and tell him that Wayne wants to talk with him (603-588-0107), maybe a whole bunch of letters will break through this protective wall. You'll do that for me, won't you?

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REVIEW

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More Hams Among Sept. 11 Missing

Bill Ruth W3HRD was a veteran of two wars and spent nearly 30 years as a social studies teacher. He has now been declared dead in the September 11th attack on the Pentagon.

According to the *Washington Post*, Ruth was a retired Army Chief Warrant Officer who lived in Mount Airy, Maryland. On the evening of Sept. 10th, he had presided over his first meeting as commander of his local Veterans of Foreign Wars post. The following day, he was at work in the Pentagon when a jetliner

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Wise Up & Beat the Odds

NEVER SAY DIE

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www.waynegreen.com

Surviving Bioterror

A couple of years ago, I was about the only one writing about the bioterrorism threat. Now it's the cover story of *Newsweek* and *Time,* and in feature articles in *Fortune,* etc. The World Trade Center attack finally woke the media into its usual pack action. But, how about you, are you awake yet?

Yes, the government has been asleep on this, too — despite a 1993 federal study reporting that 250 pounds of aerosolized anthrax sprayed over D.C. could kill up to three million people. The fact is that America is almost totally ill-prepared to deal with such an assault.

Bush's appointment of Tom Ridge as the antiterror czar, but then not giving him control over the counterterrorism budgets, gives him little real power. With dozens of federal bureaucracies, all fighting for more money, and doing their best not to communicate with other agencies, it's the usual D.C. mess. We have the State Department, Defense Department, Customs, FBI, CIA, NSA, DIA, CDC, NIH, FEMA, FDA, and on through the alphabet, all protecting their turf.

I hope you took time to watch the recent PBS series on the drug war. It demonstrated the incredibly stupid way Congress went about dealing with the drug problem and the mess it's made — plus hundreds of billions of our tax money that's been totally wasted — not to mention thousands of lives.

Alas, I suspect this may be a blueprint for the war on terrorism.

To start at the beginning: Anthrax seems like one of an enemy's most likely weapons. It's easy to make and freeze-dry into a powder. It's easy to disburse. By mail — pouff! — you're infected, from crop planes, a hot air balloon, a drone aircraft, spray cans, the Empire State Building observation deck, and so on.

Well, what about getting vaccinated against anthrax? Sure, once the company (Acambis) that's supposed to be making it gets the bugs out of their system. Once they're able to safely make the vaccine, the first few million doses will go to the military and then government employees.

Oh, yes, there's one more complication. The immunization requires six doses of vaccine given over 18 months, followed by yearly boosters. There's no word yet on the "acceptable losses" due to adverse reactions to the vaccine. We do know that many Gulf War veterans who got anthrax vaccinations had hellacious long term reactions to it. This does not inspire confidence in the whole immunization process. You'll have even less if you read Walene James' *Immunization, The Reality Behind the Myth* (see page 7 of my *Wisdom Guide*), or Harris Coulter's *Vaccination — Social Violence and Criminality — The Medical Assault on the American Brain.*

Now, the gritty-nitty — here's what you can — no, make that *must* — do.

Since telephones are usually the first service to fail in emergencies, and since our government has not established any national emergency communications alternative, it's going to be radio amateurs who will, as in all past serious emergencies, provide it.

• If you don't have a ham license, for heaven's sake get one — just memorize a few Q&As.

• Get a handie-talkie and get trained on emergency procedures over a local repeater.

• Join the local radio club and help them set up a van that will be able to permit all of the mobile radio services to intercommunicate. Like fire, police, doctors, hospitals, ambulances, sheriffs, the military, CB, CAP, FBI, Secret Service, and so on.

• Urge every inactive licensed ham in your area to get on the stick. Look 'em up on a *Callbook* ROM and call them.

• Keep a couple of gallons of silver colloid on hand, plus the ability to make a whole lot more. This is one of the most powerful antibiotics there is and it costs pennies to make. The anthrax death rate is around 90% for those without antibiotics, and within three days after the first symptoms of a fever and a cough appear.

• However, the best protection against any pathogen is a powerful immune system. Have you started rebuilding the damage you've been doing to yours yet?

The Silver Bullet

Shades of the Lone Ranger! Well, our medical-pharmaceutical complex has done it to us again. I mean the overuse of antibiotics which has resulted in bacteria becoming resistant.

Researchers estimate that around half of antibiotic prescriptions are unnecessary. Then we put 70% of the antibiotics we produce into livestock — and eat the antibiotic-laced meat. All this encourages the weak microbes to become stronger. The result is that bacterial infections, including tuberculosis, pneumonia, and meningitis, which used to be easily handled with antibiotics, are becoming deadly.

Which leaves us with silver colloid, to which microbes have been unable to adapt.

With the increasing threat of biowarfare, it seems only prudent to have some silver colloid on hand. No prescription needed, and it's el cheapo to make, at a penny or two a gallon.

But, do your homework. Read *The Plague Makers* by Dr. Jeffrey Fisher (page 22 in my *Wisdom Guide*), and then *The Silver Micro-Bullet* by Dr. Paul Farber (page18, *ibid.*). How do you make and use it? Read the Miller *73* article in the April 1997 issue. If you have been totally imprudent and don't have that issue, a reprint of the article is available for $5 from Radio Bookshop—item #98, see page 63.

You can read more about the antibiotic resistance mess

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piloted by a suicide terrorist slammed into the building.

In addition to a lover of ham radio, Bill Ruth was described as an avid Redskins fan and a motorcyclist who enjoyed riding in Maryland's rolling hills. A Vietnam and Gulf War veteran, Ruth held a master's degree and taught for nearly three decades, most recently at John T. Baker Middle School in the town of Damascus, Maryland.

In addition, the *ARRL Letter* reports that missing are Rod Coppola KA2KET, 46, of NYC, who was the transmitter engineer on duty for Public Broadcasting station WNET, channel 13 at the time the attack occurred, Winston Grant KA2DRF, 59, of West Hempstead, NY, who was a computer technician with Empire Blue Cross/ Blue Shield.

Neither man has been seen since the twin towers collapsed after being hit by hijacked jetliners on September 11th, bringing to seven the number of hams known to have been missing since that day.

Thanks to Daily DX, Washington Post, *ARRL, and Henry Feinberg K2SSQ, via* Newsline, *Bill Pasternak WA6ITF, editor.*

Financial Assistance for Missing Engineers' Families

The Portland Chapter of the Society of Broadcast Engineers and the ARRL both report that a fund has been established to assist the families of broadcast engineers still missing at the collapsed World Trade Center. Checks can be sent to the Ennes Educational Foundation Trust, c/o The Society of Broadcast Engineers, Inc., 9247 N. Meridian St., Suite 305, Indianapolis, IN 46260. Please mark your envelope to the attention of the "Broadcast Engineer Relief Fund."

Thanks to ARRL, Portland SBE, courtesy of Newsline, *Bill Pasternak WA6ITF, editor.*

Indiana Hams at Ground Zero

Ham radio operators from Indiana were among those who made the trek to New York City to aid in rescue efforts after the September 11th terrorist attack. Their job was communications.

Thirty-six hours after the first airplane crashed into the World Trade Center, Indiana's Task Force One was standing at the ground zero. Among the 62 members of this elite search and rescue team were two Indianapolis amateur radio operators.

Veteran firefighter Jim Curseaden KB9ZFF and Ed Elrod W9PTO made the 14-hour road trip to help with disaster efforts. Both men made up the communications arm of this search and rescue team.

The moment they arrived, each man began setting up a UHF communications link from ground zero to their staging point several miles away at the Javits Convention Center. According to Jim Curseaden, getting UHF signals through the concrete canyon of New York City was a major challenge.

Ed Elrod said they first installed a repeater on a nearby building and directed a yagi antenna at the mountain of rubble. The Javits Convention Center posed another radio obstacle. Hand-held radios could not reach the repeater.

To fix this problem, Elrod wired a up a remote base on the roof of the convention center. This new link made it possible to communicate with the Indiana Search and Rescue personnel above and below the World Trade Center ruins.

Ed Elrod's most inspirational moment came during his second trip out of the devastation.

All week, hundreds of people had been lining the streets, cheering and showing signs of support. When heavy rains began dousing New York, the crowds disappeared. He said the contrast was amazing. The streets were nearly empty; except for one lonely figure standing in the rain. It was an elderly woman, holding a sign that read: "Thank You."

Thanks to Jack Parker W8ISH, via Newsline, *Bill Pasternak WA6ITF, editor.*

CQ Contest *Magazine SK; Ditto Hard-Copy Logs*

CQ Contest, a magazine devoted to the art of amateur radio contesting ceased publication with its October, 2001, issue. *CQ Contest* had been published 10 times per year since 1996.

CQ Communications President and Publisher Dick Ross K2MGA said that the move was "a purely business decision" and that subscriptions to the specialty magazine would be fulfilled "on a dollar-for-dollar" basis with the company's flagship magazine, *CQ Amateur Radio.*

Writing in the final issue, *CQ Contest* Editor Bob Cox K3EST, explained that "good business economics" dictated that CQ Communications could no longer continue to publish *CQ Contest.* He thanked the readers for their "ideas, generosity, and loyalty." Cox also said he's working on developing an independent contest magazine on the World Wide Web, which would fulfill subscribers' terms if it is launched.

In a separate "Message from the Publisher," Ross explained that approximately $750,000 has been invested in *CQ Contest* since its launch in 1996, with cumulative losses exceeding $150,000. "As much as I love contesting," Ross said, "it no longer makes sense from a business standpoint to continue to subsidize CQ Contest ..."

In the meantime, following the events of Sept. 11, *CQ* has announced that all contest log submittals will henceforth be accepted in E-mail format only, and that there would be no guarantee that mailed entries would ever be opened.

Thanks to CQ *E-mailed press release, published reports.*

Ham Survivor at WTC

A cause to rejoice amidst the chaos is the case of an amateur who worked in the World Trade Center. Rob Nall WVØS reports that his friend, Herman Belderok, Jr., KBØEEB, managed to get out of his building just minutes before the structure collapsed. Thankfully, Herman survived unscathed.

Thanks to WVØS, via Newsline, *Bill Pasternak WA6ITF, editor.*

Where Have All the Amateurs Gone?

Remember the old Kingston Trio folk tune, "Where Have All the Flowers Gone?" Well, it's now over a year since restructuring, and observers of the Amateur Radio service are asking where all the hams have gone. The answer is that they are on the move with the rest of society.

What growth ham radio is experiencing is following population shifts. That's according to W5YI VEC Administrator Fred Maia. According to statistics Maia recently published, about 682,000 people in the United States hold Amateur service licenses. Of these, just over 95,000 are Extra class, 87,000 are Advanced, 137,000 are Generals, and 320,000 are Technicians. Finally, 42,000 hams continue to hold onto their Novice class licenses.

Right now, more than half of all licensed hams in the US live in 10 of the 50 states. The states with the highest amateur populations are California, 102,000; Texas, with close to 42,000; and Florida, with almost 40,000. New York state is fourth with 32,275 hams.

The four states with the fewest hams are Wyoming, with 1,615; South Dakota, with 1,588; North Dakota, with 1562; and Delaware, with only 1389 hams.

But even these numbers are changing. Maia says that even though they have relatively small ham populations, Utah, Wyoming, Nevada, Idaho, Arizona, and New Mexico had triple the ham radio population growth of other states. Texas, along with Oklahoma and Colorado, had double the ham growth of other states.

And here's a twist. If you consider high population states with major cities like California, New York, and Illinois, they had no growth at all. In fact, Maia says some of those states actually suffered a net loss in the number of hams.

Why this is happening may have something to do with employment. Business trends are changing. Many high-tech companies wanting to reduce operating expenses are moving to less populated areas. Where the companies go, so do the job seekers, with many high-tech workers likely being hams.

Thanks to David Black KB4KCH, via Newsline, *Bill Pasternak WA6ITF, editor.*

More Hams Upgrading, But Little New Blood

A lot of hams are upgrading but there are few new people coming into the hobby. That was the bottom line as we passed the halfway point in the year 2001.

According to a person who should know, in the last four years the United States Amateur Radio Service has grown at a rate of only 2,000 additional hams annually. That's about three tenths of one percent per year and less than the United States Census Bureau's total projected percentage increase in the total population of the country.

The person presenting the facts is Fred Maia W5YI, who heads up the W5YI VEC and has been carefully evaluating trends in ham radio for over two decades. And what he has found is good reason for concern.

According to Maia, four years ago, the total Amateur census stood at 674,000. It now stands at 682,000. But, says Maia, an additional 30,000 amateurs are still listed in the FCC's database which includes those whose licenses have expired, but who fall within the government's 2-year renewal grace period. That's the time when you cannot operate a station but can renew without taking an exam.

Maia says that the FCC is now canceling about 1,500 licenses every month that are not renewed within that grace period. He suspects that many are silent keys.

The good news — if you can call it that — is that hams upgraded their licenses in unprecedented numbers. Maia believes that this was motivated by the FCC's restructuring of the United States Amateur Radio Service. With the reduction of the top Morse testing speed to 5 wpm, most Technician Plus, General, and Advanced class tickets upgraded simply because the 13 and 20 word per minute code exams were no longer required. As a result, and to the delight of equipment suppliers, tens of thousands of potential high frequency operators have been added to the all-band rolls. By license class that's 20,000 new Extra class and 27,000 added Generals.

But there is another side to the equation. As you might expect, the Novice, Technician Plus, and Advanced class — all of which have essentially been placed in limbo since restructuring — have seen comparable decreases in numbers. Advanced is down by about 15,000. The Tech Plus is down by 40,000 and there are 8,000 fewer Novices. The Tech Plus got a double-barrel hit since this license class is no longer being issued. Instead, the database of Technician Plus and Technician class have been lumped together in the FCC's database. Existing Tech Plus license holders are having their tickets renewed as Technician even though they hold a 5 wpm code credit. This, says Maia, distorts the total of No-Code Technician class statistics since many Technician class holders do indeed hold Morse Code credit.

There is some good news. Statistics show that about 1,600 new code-free Technician class hams are licensed for the first time each month. That's close to 19,000 annually.

The first code-free Technician class tickets began appearing in the spring of 1991. It's now a decade later, and these licenses are just coming up for renewal. But, says Maia, it is very difficult to determine from the FCC's licensing records the percentages of eligible Technician and Technician Plus operators that are renewing their licenses.

According to Maia, whose VEC operation also handles license renewals — it appears as if many are not. Maia says that the Technician class has

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Never say die

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in the May 2001 *Scientific American*.

Kontent Is King

If you'll peek over my shoulder into my crystal ball, which hasn't failed me yet, you'll get a good look at the future. Now, are you planning your life so as to take advantage of what's coming, or watching Seinfeld and Frasier reruns?

Yes, the rush of Internet dot-coms was premature. The Internet is still in the hand-cranked party line telephone stage of growth. The Web infrastructure is still rickety, with aged servers and telephone line choke points for most subscribers. We're heading toward a time when the world is fiber-opticked and a movie can be fast-forward downloaded in seconds. You want to read a book? Szzzt, and you've got it downloaded for a buck. No printing, no distributors or bookstore inventories. Hey, no book publisher — you've downloaded it from the author.

Who needs Sony Music or Warner Brothers when a musical group can sell direct to the end users via the Web? We'll download an hour of music in a couple of seconds and burn it into our own CD.

This is not a good time to make a long-term investment in any publishers or record companies. Just as Wal-Mart and the other discount chains have put most downtown stores out of business, we'll be seeing the Web doing major surgery on the whole merchandise distribution system.

In a few years (months?), I won't have to fight the fast-talking salesmen at the discount camera stores to buy the new digital camera — I'll get the lowest price from the manufacturer or the importer. Why should I drive an hour to Manchester or Nashua and deal with a sales clerk who knows almost nothing about the stuff he's selling when I can go to the Nikon site and get any info I want, and then get the camera at a far lower price than Circuit City or Buy Right?

We're still going to need the giant companies for hardware — it's in the content that small businesses and entrepreneurs will be king.

Got you thinking yet?

Okay, if that didn't get your gray cells jumping, let me jam a thinking cap over that square protuberance above your shoulders.

Do you have any special interest that you know more about than 99% of the public? It can be your work or a hobby. If you don't, it's time to get a life. Step one is to get busy and outline a video presentation which will help that 99% learn more about your interest and why it's so interesting. Step two is to get a digital video camera and computer editing system and start producing the video. All you need is a camera and an iMac system. I got mine a year ago and the whole works then only cost $2,500. Since then prices have, as usual for electronics and computers, dropped. Let me know what you find that works and I'll pass it along.

If you love to fly kites, well, get at it and show us how to do it and explain why it's so much fun and costs so little to enjoy. I'll pay a buck anytime to download something like that.

If you know how to make and fly ultralights, tell and show us. Or one of those flying parachutes!

We're heading into a world where content will be king and give you the Midas touch — if you are prepared.

For all its problems, e-commerce is already a $34 billion business and growing at 35% a year. Compare this to the traditional retail growth of 4% to 5% per year! And this with the crude Web system we have to work with.

What customers want is the ability to shop via the Internet — to see a video showing them the benefits and features of a product, and to be able to answer their questions. I want to see what the latest ham rig can do for me — what all that maze of knobs and buttons are for and how I'm going to have the time of my life twisting and pushing them.

And then, if I can't stand for one more day not having, I want it delivered pronto.

And there's the big catch. America's infrastructure is seriously outdated. We're not going to be ordering Webvan-like groceries which can't get through the traffic jams. Or stuff coming by air to airports that are overloaded. When I tried to fly to California to give a talk to a ham club I only got as far as Chicago before United Airlines gave up and sent me back to New Hampshire. I had to do my talk over the telephone.

Our roads are cracking and potholes proliferating, our bridges crumbling, and our airports are desperately in need of more runways. Harbors are silting up, landfills choking with old PCs, and our water is running dry. It's been 40 years since we've made a major infrastructure investment, and we're suffering because of it. The estimated cost? About $1.5 trillion, the same as the recent tax cut. With an estimated $20 trillion industry as the prize, it's time to give your politicians a hot foot. Try to get their minds off those fat envelopes of cash and vacation trips from lobbyists, and onto the voters.

In the meanwhile, are you getting ready to get a piece of the action? Hey, wake up, I'm talking to you.

The competitive market for creative music, books, films, art, and so on will, I predict, precipitate an explosion of creativity. The hold the music and book publishers have over these industries will blow away when they can no longer prevent prospective customers from knowing about new works. The big company control over distribution to book and music stores will blow away. No more bookstores or music stores.

One thing that is needed is a reliable source of information on what's good and what isn't. It was my providing this information via my *CD Review* magazine when CDs were first introduced that helped CDs become the fastest growing consumer electronics industry in history. We mercilessly reviewed new CD releases and we polled our readers on how much they liked the sound, performance and the music on the CDs they'd bought. The result was a disaster for the major labels, with sales on independent labels going from 4% of the market to 16%, a loss of billions for the majors.

Someone ought to start a magazine and Web site for music and books available over the Web. It's a huge niche with the potential for making millions. You'd be able to download reviews and ratings for the top-rated music of any kind that interests you for a dime. Ditto books. Or spend $20 for a year of *Merciless Music Reviews* magazine or *Merciless Book Reviews* magazine.

It costs about $750,000 these days to get a new magazine up and running — anyone interested? Having started a couple dozen successful magazines, I know the ropes and will be glad to help.

Vaccines

I've written about vaccines several times. I've even included a review of Walene James's *Immunization — The Reality Behind the Myth* in my *Wisdom Guide* (p. 7). But the fact is that you are still allowing the medical/pharmaceutical industry to vaccinate your children and you're baring your arm (or rear) whenever a doctor says to. I know, it's too much trouble to do some reading and become informed — and Wayne's a nut about the medical industry anyway.

The June Acres U.S.A. had a most interesting article on vaccines. This monthly publication ($27/yr.) is the best I've found to provide honest reporting on medical and food matters (call 800-355-5313 to subscribe). Where else would you find out about Linda Fisher being nominated for

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[thomil@bioelectrifier.com]

Microwind to the Rescue!

Let the wind keep your emergency batteries charged.

Wind-powered generators have been around for a long time, but this unusual and efficient wind-powered generator is really something different.

Finishing a project always brings two things — a sense of accomplishment, and a pile of leftover parts. In this case, the project was a CNC-controlled drilling machine for fabricating circuit boards. Among the leftover parts were various pipe fittings, some scraps of angle iron and several hefty stepper motors.

I hadn't really decided what to do with the leftovers until I noticed the trash one of the neighbors had carried to the curb. On top of the pile was a rather beat-up box fan, and since it was very windy, the fan was spinning so fast I couldn't see the blades. Somewhere in the back of my head where new projects begin, a light went on. If this thing spins so well in the wind, fitting it to one of the stepper motors could make a small wind generator. It could possibly generate enough "free energy" to help keep my emergency batteries charged, especially in stormy weather when there is an abundance of wind and the solar panels are not producing anything. I carried the fan home with me, took it apart and removed the plastic blade assembly from the motor. The rest of the fan went back to the curb.

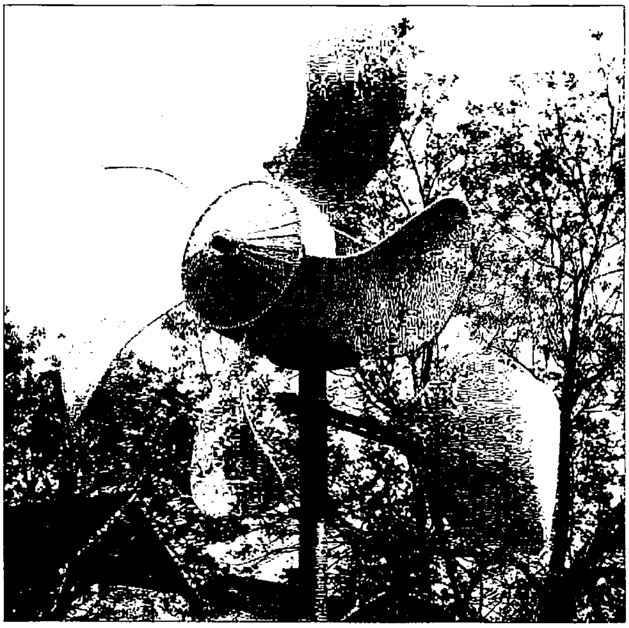
Photo A. The Microwind generator.

Most small wind generators use DC motors to produce direct current. The problem is that small DC motors run at very high RPM, and when used as a generator will not produce enough voltage to charge a battery until things are spinning much faster than a typical wind generator can safely turn.

Unlike a DC motor, a stepper motor has a permanent-magnet rotor inside a wire-wound field. When the field windings are energized, the rotor "steps" to the next pole, making the stepper useful for critical positioning tasks. However, when the shaft of a stepper motor is rotated, it becomes an alternator, producing AC current. Most precision steppers are designed with a step angle of less than two degrees, so there are LOTS of poles. Since the low-speed performance of an alternator increases with the number of poles, it follows that a stepper should work very well in a low-speed wind-driven configuration.

To test this assumption I selected one of the larger stepper motors and clamped the mounting flange in the vise. Checking the six leads with an ohmmeter, I discovered that there were

two separate windings, each with a center tap. I set the meter on AC VOLTS and connected it across one winding. To monitor the output frequency. I connected my old B&W frequency counter across the winding as well. Spinning the motor with a cordless electric drill produced over 40 volts at 375 Hz! With a center-tapped winding. this would be perfect for a simple full-wave rectifier. In addition. with another winding to generate a second phase. the output from a second rectifier could be connected in parallel with the first. increasing the output current.

Photo B. The emergency station: The Argonaut. HTs for 2 meters and CB. a scanner. 4" television. all-band receiver and 600-watt inverter. all powered from a 12-volt deep-cycle battery. The Microwind keeps it charged and ready!

Attaching the blades

The next step was to find a way to mount the fan blades to the motor. The stepper motor has a 5/16" shaft. The fan hub I had scrounged from the trash heap was designed to fit on a 5/16" flatted shaft, however it wouldn't mount directly on the motor since the blade hub would not clear the motor flange.

To solve this problem I took a 2" long piece of 3/4" diameter aluminum bar stock and drilled a 1/4" diameter hole straight through from one end to the other. From one end, I tapped the hole with a 5/16"-18 thread. Turning the piece around. I bored it halfway through with a 5/16" drill. On this end, I also drilled in from the side with a #36 drill and tapped the hole for a #6-32 set screw to hold it onto the motor shaft.

Photo C. The motor mount turns freely on the mast pivot.

I first mounted the extension to the motor shaft and tightened the set screw. I then drilled through the fan hub with the 5/16" drill. used a small round file to remove the flat side from the plastic bore and secured it to the extension with a 5/16" bolt and lock washer. Everything cleared. and it spun without any serious wobbles, so I took the motor/fan assembly outside and stood in the driveway facing the wind. I was pleased when. on the next gust, the fan started to spin ... I had a Microwind generator!

Mast and pivot bearing

Now that I had a way to mount the blades onto the motor. I needed to find a way to mount the assembly up in the air. Checking through the pile of left-over parts. I found a piece of 3/4" water pipe and a matching floor flange. I also had a few 3/4" pipe nipples 6" long. and some short pieces of 1/2" EMT electrical conduit.

I slid the conduit down into the 3/4" pipe until about 8" was sticking out the end. It was a loose fit. so I drove a couple of small nails into the gap to tighten it up. Since I have a small welder. I spot-welded the two pieces together. Then drove a 5/8" flat washer down over the conduit to rest on the pipe. (If you don't have a welder. steel-filled epoxy should work just fine.) The pipe. conduit and washer would serve as both the mast and the pivot bearing so that the Microwind generator could yaw freely into the wind. I also cut a 1/2" wide ring off the end of the 3/4" pipe. which I drilled and tapped for a #6-32 set screw. This would become a retainer to prevent the generator from slipping off the end of the conduit. This is shown in detail in **Fig. 1**.

Mounting the stepper motor

I had a rail from an old bed frame I'd

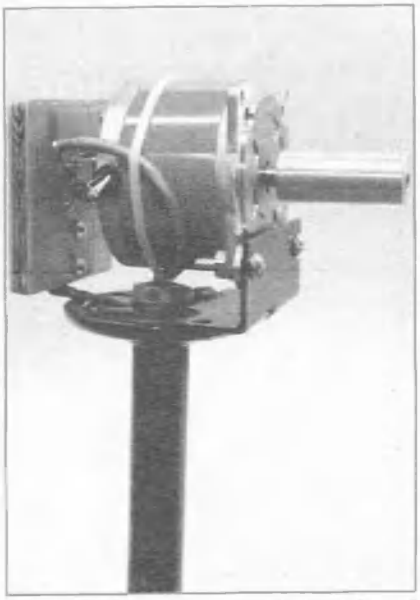

Photo D. Stepper motor and circuit board attached and wired. The cable passes down through the center of the mast.

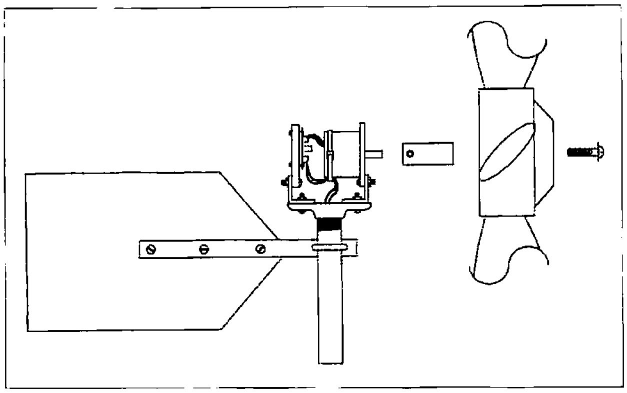

Fig. 1. Microwind generator assembly.

scrounged from the trash, and it was made from 2" wide angle iron. I cut a 4" long piece of this and drilled two 1/4" holes in it to fit the mounting flange of the stepper motor. It's important to keep the holes as close as possible to the edge of the angle iron, so that when it's mounted, the motor will be as high as possible.

I threaded the 6" pipe nipple into the 3/4" pipe flange. Turning the flange over so that the flat side was facing up, I clamped the angle iron motor mount to the flange with locking pliers and spot-welded them together. A pair of 1/4" bolts and nuts would work fine for this, but since I had the welder out anyway, welding it was quicker. While I was at it, I found a small right-angle corner bracket and welded it onto the other side of the flange, facing in the opposite direction. This would provide a place to mount the small rectifier circuit board, making it possible to bring two wires down the mast instead of six.

Putting it all together

Clamping the mast pipe into the vise, I slipped the generator head assembly over the conduit pivot post. The conduit was a bit long, hitting the motor, so I used a tubing cutter to trim the pivot until, with the end of the pipe nipple resting on the 5/8" washer, there was just barely enough conduit above the flange to mount the 1/2" wide retaining collar. I also carefully deburred the inside of the conduit so that there would be no sharp edges to cut the wires. Once I was sure that everything fit and would rotate freely without binding, I took it apart and painted the generator head assembly. When the paint was dry, I rubbed a thick coat of grease on the pivot and re-assembled everything. Bolting the stepper motor, shaft extension and fan blades onto the head assembly, the Microwind generator was starting to take shape.

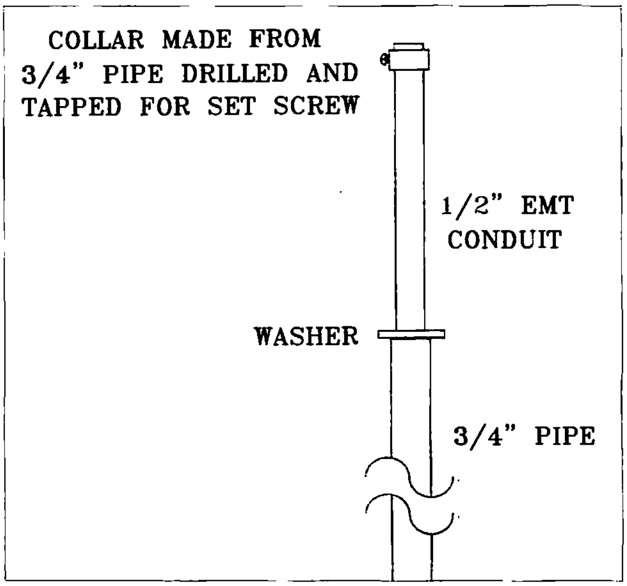

Fig. 2. Mast and pivot assembly made from pipe and conduit scraps.

One thing lacking, however, was a tail to keep it pointed into the wind. Once again, scrounging the junk pile, I found a section of light steel slotted "U" channel intended to mount adjustable shelf brackets to the wall. I cut an 18" long piece and drilled two holes to clamp it to the generator head with a small "U" bolt and nuts. I cut a tail fin from a piece of plastic sign board and fastened it to the tail boom with #6-32 screws and nuts. **Fig. 2** shows the assembly details for the Microwind generator.

Electrical circuit: two-phase AC to DC

With the mechanical assembly finished, the next step was the electrical hookup to get power out of the machine. Bringing two-phase AC down the mast is not practical, since it would require six wires. A much better idea is to install a two-phase rectifier at the stepper motor and bringing the DC output down using only two wires. **Fig. 3** shows the circuit, which is actually two separate full-wave rectifiers with the outputs connected in parallel. I made a small circuit board to mount the rectifier diodes and terminal blocks to make the connection simple. **Fig. 4** shows the component layout.

The circuit board was assembled, the flux cleaned from the soldered connections, and the board was heavily sprayed with clear urethane to seal it. (Put a piece of masking tape over the terminal blocks before you spray!)

The circuit board was then mounted on a 3-1/2" x 4" piece of plywood using small plastic standoff spacers and #4-40 screws and nuts. The plywood was also sealed with clear urethane. Once all the urethane was dry, I connected the wires from the stepper motor to the terminal block, and also used a piece of two-conductor cable about ten feet long to connect to the DC output block. Once everything was connected, the plywood with the circuit board attached was mounted on the small corner bracket behind the stepper motor. I fed the cable down through the center of the mast, and anchored it to the stepper motor with a large nylon wire tie, positioning it carefully so that it passed straight through the center of the 1/2" conduit without touching the edges. Note that this is why it's necessary to mount the motor as high as possible — to get room to pass the cable down through the mast.

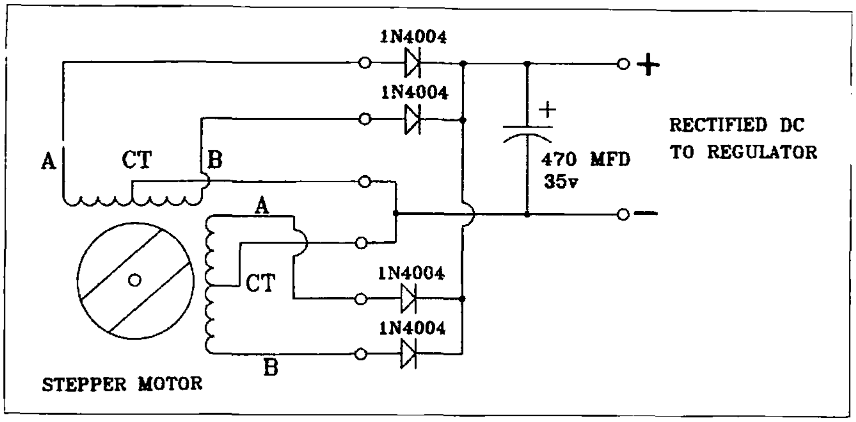

Fig. 3. Stepper motor generates two-phase AC, which is rectified and filtered before bringing the power down to the shack.

Bringing the power down to the ground

I've built several wind generators in sizes ranging from the Microwind up to machines with eight-foot rotors, and I have never needed to use slip rings and brushes at the top of the tower. To prevent wrapping the wires around the tower, I have always simply attached the wires at the top with a strain relief, and passed the wires down through the center of the mast. At the bottom of the mast, I let the wires hang straight down for twenty feet or so. The wires can't wrap around anything, and in the event that the wind does turn the generator a complete 360 degrees, all that happens is that a single twist is put into the pair of wires. I installed a plug at the bottom of the tower, so that should the wires ever accumulate more than a turn or two, it's a simple matter to unplug the wire, untwist it and plug it in again. This doesn't happen as often as you might think, since the wind tends to even out. My biggest machine was up for a full year before we moved, and in that time I unplugged and untwisted the wire exactly once. This is hardly worth the added complexity of brushes and slip rings.

Once all the electrical connections were made and the circuit board was mounted, I sprayed another coat of urethane over everything, including the stepper motor. This would protect the connections, and also keep any water from seeping into the motor through the seams. I then cut a small piece of aluminum flashing and bent it into a "U"-shaped cover, which I attached to the plywood with two screws. This covered the motor and electrical connections to protect them from direct exposure to the weather.

Once the urethane was dry, I carried the Microwind generator up onto the shop roof and used a pair of large hose clamps to attach the pipe mast to the 4" vent that came up through the roof from the bathroom. I connected the end of the two-conductor cable to a

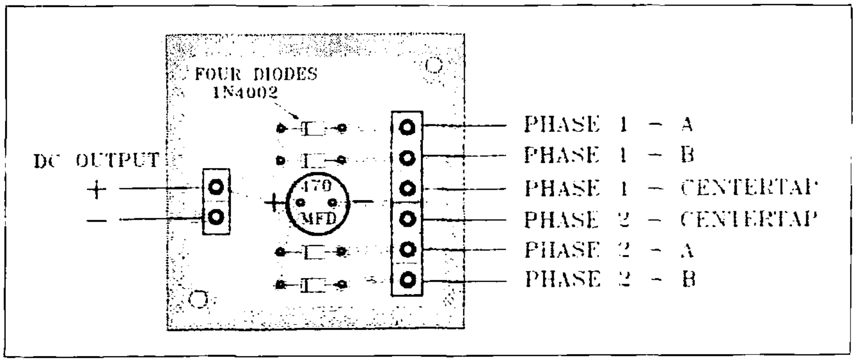

Fig. 4. Component layout for the rectifier circuit board.

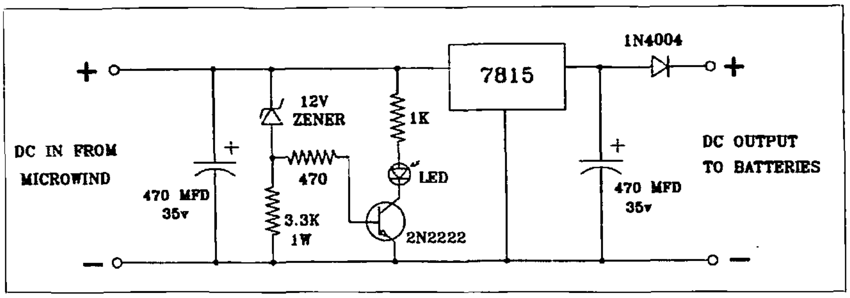

Fig. 5. The regulator prevents voltage peaks from damaging equipment. The LED lights when the voltage from the Microwind generator reaches 12 volts.

section cut from an old 100-foot extension cord, dropped it down the middle of the tower and brought the other end into the shop.

First tests: stormy weather!

The very next evening a strong weather front passed through our area, and as the temperature dropped, we also had some very strong, gusty winds. I hooked up a multi-meter in series with the positive lead and set it to measure current, then connected an analog 0–30 volt DC voltmeter across the line. For a load, I found a bullet-shaped 12-volt trailer clearance light and connected this to the line.

To my surprise, the Microwind generator picked up a strong gust and the trailer light started to glow brightly … it was producing quite a bit of power in the gusts. I watched the meters through the evening, and at the strongest peaks I was able to measure over 20 volts at 750 milliamps. I measured 10 to 15 watts many times through the evening whenever the wind picked up.

Obviously, this is not enough to power your house, or even a good-sized light bulb, but it's plenty to trickle-charge a car battery used to operate an emergency ham station when the power grid is down. By comparison, a 10 watt solar panel costs between $100 and $150, and it will not generate a single milliamp at night, or when the sky is darkened by storm clouds.

Regulator circuit

It is not a good idea to connect the Microwind generator directly to a battery used to power your emergency ham rig. Once the battery is fully charged, the voltage in wind gusts could reach 25 volts or more, which could be bad news for any electronic equipment connected to it. **Fig. 5** shows a simple regulator circuit to clamp the voltage to 15 volts, a level that is safe for most electronics made to be powered from a 12-volt circuit. Also included in the circuit is an isolation diode to keep the 12-volt battery from discharging backwards through the circuit. This is always good practice, especially when you have other sources of charging current, such as a solar array. I also included a zener diode and a small transistor, which acts as a voltage-controlled switch. When the voltage crosses the 12-volt threshold, the LED will light, indicating that the charging level has been reached. The circuit board component layout is shown in **Fig. 6**. Both the two-phase rectifier and the regulator boards are identical in size. The foil patterns for the boards are shown in **Fig. 7**.

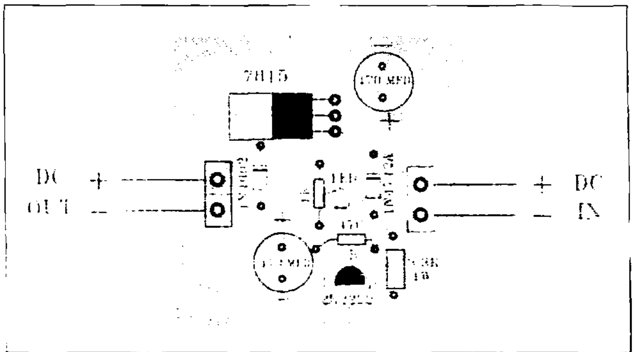

Fig. 6. Component layout for the regulator circuit board.

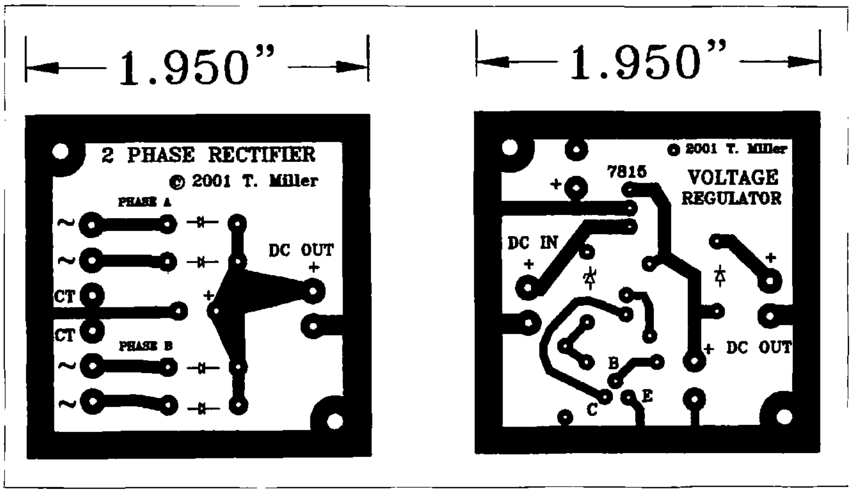

Fig. 7. Printed circuit board patterns for the rectifier and regulator.

More is better!

Since the Microwind project worked out well and I still had a few stepper motors left over, I located a few more junk fans and salvaged the blades. I now have three of these little machines spinning happily in the wind. One of the fans had a 1/2" shaft, so when I made the extension piece I chucked it in the lathe and turned one end down to 1/2" outside diameter after drilling, tapping and boring through the center. I filed a flat on it to fit into the fan hub and secured it with the 5/16" bolt. This particular fan blade had a large flat center hub, which was not very streamlined. In order to cut the wind loading, I found a white plastic funnel that closely matched the diameter of the hub and mounted it with four small sheet metal screws.

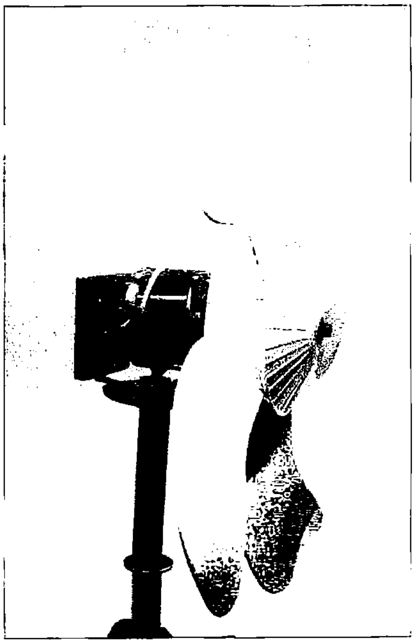

***Photo E.** The Microwind generator with blades attached. All it needs now is a tail to keep it pointed into the wind.*

The shop roof proved to be a less-than-ideal location for a wind generator. Located behind the house, the air swirled over the roof and down onto the shop in all sorts of eddies. The Microwind generator spent most of the time yawing back and forth, trying to track the shifting wind. I installed one of them on top of the 45-foot tower beside the shop, which is the proposed location for a large generator. This "next generation" wind machine will utilize an alternator made by adding neodymium magnets to the rotor of a single-phase AC induction motor. While I'm working on this project, the Microwind generator is giving me information on the wind speeds and directions I can expect when it's big brother arrives on the site. So far, it's showing a dramatic difference between the high and low sites. A good rule of thumb is to locate any wind generator 12 to 15 feet above any nearby obstructions.

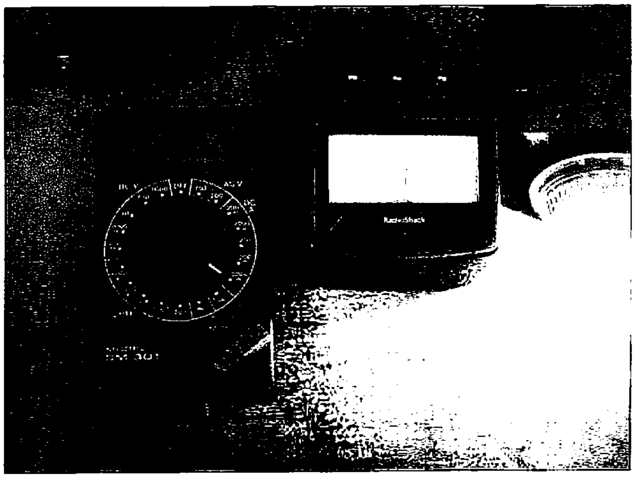

***Photo F.** In a strong wind, the Microwind produced more power than expected!*

The Microwind generator is a fun project and provides a good, simple introduction to wind technology. It's also an unusual and practical application for surplus stepper motors. More experiments in this area could be interesting... the small plastic fan blades are not driving these steppers to the maximum, so it might be worthwhile to build larger, more efficient blades, possibly using a bicycle chain and sprockets to spin the stepper faster than the blades. There are also much larger stepper motors out there, and these do show up as surplus from time to time. In the past, I've worked with steppers that drew over six amps per winding. One of these could have some real potential for use as an alternator.

For the radio amateur, batteries are necessary to power the station in emergency conditions when the grid may be down. My emergency station is located in the basement, and consists of an elderly but functional Ten-Tec Argonaut, handie-talkies for 2 meters and CB, a scanner, a small television and a portable all-band receiver. All this is powered from a large marine battery, which also feeds a 600-watt inverter to provide 120 volts AC. A small relay brings the inverter on automatically when the power fails. Like many hams, I use a small solar panel to keep

Photo G. This version sports a nose cone made from a plastic funnel.

single piece came either from my junk box or from the street corner during the local Spring Cleanup. All the materials, including the angle iron, pipe, conduit and assorted nuts and bolts can be found new at your local hardware store, but there's no reason not to adapt the design to utilize whatever materials you can find lying around.

The one piece that requires some fabrication is the blade adapter. This can be made with hand tools if you're careful, since by drilling the piece straight through first, then boring it out halfway to fit the motor shaft, the two ends should be concentric. Still, if you have a friend with a small lathe, this can be done more easily and accurately.

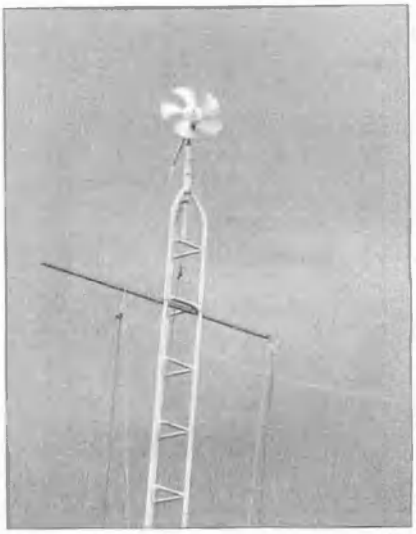

Photo H. High atop the tower, the Microwind generator charges the station batteries as storm clouds gather in the background. The tiny machine can survive and produce power in storms that would destroy a larger wind generator.

the backup battery charged. The Microwind generator is now adding wind power to the system. Wind and solar complement each other ... when the weather socks in and there's very little solar power available, there is most often plenty of wind. Under those conditions, the Microwind generator really shines.

Sources

There is nothing sacred about the mechanical construction of the Microwind generator ... it evolved into the present configuration because every

Stepper motors

The heart of this project is the stepper motor. The leftovers I used were NEMA 34-frame steppers made by Sanyo. The original source for these no longer lists them, but I found a good supply when I visited Dean's Hobby CNC Web site. Dean has the same Sanyo motor I used, both new and used for $35 and $25 respectively. Order directly from Dean's Web site [http://plaza.v-wave.com/deanc/] or write to him at Dean's Hobby CNC, 11222-131 St., Edmonton, AB, Canada T5M 1C3.

If you choose a different motor, be sure that it's a bipolar type. Larger, more powerful stepper motors are almost always bipolar, which means that there are two separate, center-tapped windings. Small steppers such as those used in printers and disk drives are often unipolar, having a single winding with many taps. These would require a different rectifier design, and would in any case be too small to be useful as alternators.

Electronic components

The rectifier and regulator components are very common items available from any electronics supplier. I've included part numbers from Digi-Key, Circuit Specialists and Radioshack.com for reference. For some reason, Circuit Specialists does not carry the small stackable terminal blocks, but they have the best prices for everything else

Continued on page 58

Qty.	Component	Digi-Key	Circuit Specialists	RadioShack.com
1	Transistor	PN2222-ND	PN2222	900-5369
1	Regulator	LM340-15-ND	7815	900-4504
5	Rectifier	1N4004GCT-ND	1N4004	900-2872
1	12V Zener	1N4742ACT-ND	1N4742A	900-3027
2	Capacitor	P5168-ND	CEM50-0470	900-1324
1	Red LED	LT1136-ND	L934HD	900-6088
1	470Ω Resistor	470XBK-ND	RB470	900-0371
1	1k Resistor	1.00KXBK-ND	RB1000	900-0379
1	3.3k Resistor	3.3KW-1-ND	RG3.3K	900-0702
6	Terminals	ED1609-ND	N/A	900-4110
1	Heat sink	HS105-ND	530-613	910-3263

Table 1. Parts list.

John R. Endsley, Jr. KD5IDU
5610 Cerritos Dr.
Houston TX 77035-2534
[kd5idu@msn.com]

Subdivision Subterfuge

Here's how a Houston homeowner handles his hamming.

Antenna challenge on a small or difficult lot got you down? Check out this photo essay for some handy pointers.

My solution is a manufactured vertical antenna that requires no radials, a home-brewed support, and an electrical discharge system to protect the antenna and my rig. Although not a problem in our subdivision, it could have "stealth" advantages where needed. As you can see, the ability to swing the antenna down provides easy tuning and service.

The support is 10 feet, plus the antenna's 20 feet. Such an antenna is usually top-loaded and gives excellent DX and satellite operation. My antenna is an MFJ-1798 and is tuned for 75/80 to 2 meters, as specified by the manufacturer. I have also found it to be effective on 160 meters as well. The counterpoise is located at the top. A top-quality SWR meter helps in getting good results.

The antenna is grounded by a heavy single-strand copper wire, and may be cut off during transmission by an AC

Photo A. The vertical antenna by our house.

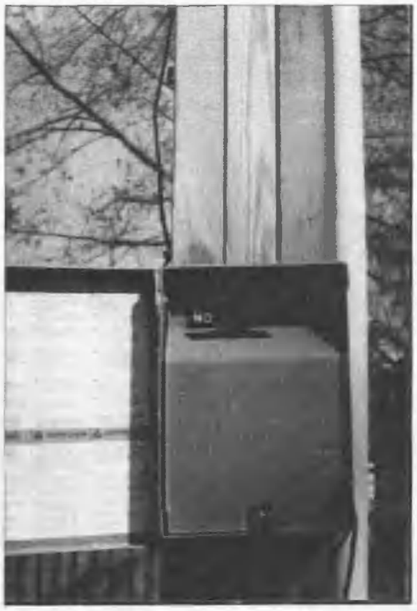

Photo B. This is the box which sets up broadcast or electrical discharge protection.

Photo C. My MFJ "Guardian Angel" surge protector.

Photo D. Antenna swung down for service or installation.

Photo E. Switch from the transceiver to the dummy load and the antenna.

Photo F. Dummy load.

Photo G. Base of antenna showing balun and loading coil assembly.

Photo H. Coax under ground from the antenna support to the entry to the house.

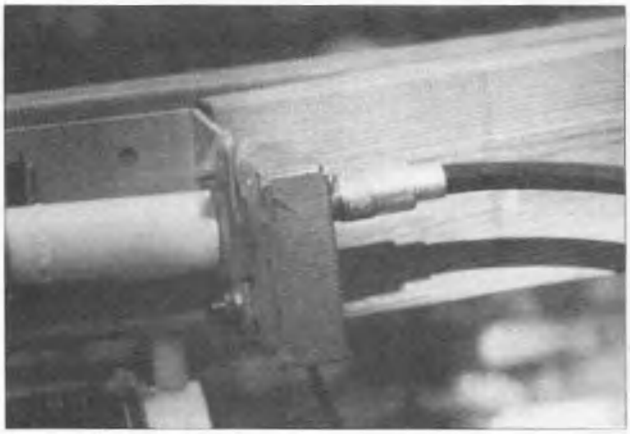

Photo I. Coax connected to antenna base.

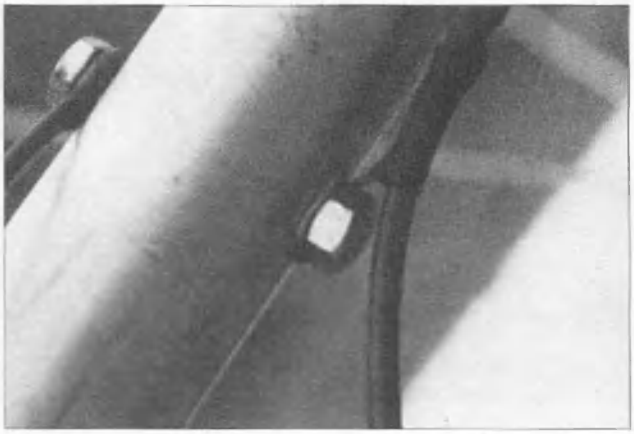

Photo J. Connection from antenna mast to ground.

Photo K. Coax enters the house.

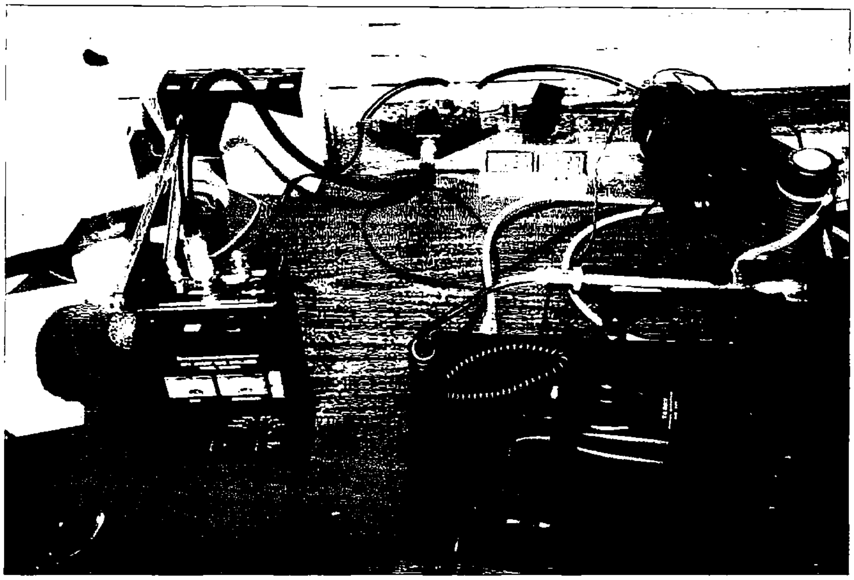

Photo L. KD5IDU's station setup.

cutoff box. A shorting bar is in place where the fuse would be if it were being used with an AC unit. The station is protected by a discharge protector, available from dealers of Poly Phaser, MFJ, and others.

There are several verticals that can serve equally well. Check out *73* advertisers.

I plan to replace my home-brew support with a 25- to 37-foot crank-up tower when it becomes available later this year.

Srikanth Bhat VU2SBJ
37 Ananth Nagar
Manipal 576119
India
[vu2sbj@yahoo.com]
[http://www.vuiota.com]

IOTA — AS096

That's St. Mary's Island to you ...

St. Mary's Island (a constituent part of the AS096 group of isles) is about 3 km from the coast of Malpe in the Udupi district. The island is barren, without human inhabitants, shelter, or drinking water. About 400 meters by 150 meters in size, the small isle is often explored by tourists who visit it for a few hours, usually on weekends when few boats offer services from the Malpe coast.

The boat takes about 25 minutes from the Malpe coast to the island. Some boats cannot go all the way to the island, and tourists are transferred into a smaller boat that will go all the way. Some other types of boats move all the way from the coast to the island.

Overnight stay on the island is restricted by the police authorities of the district. Beginning at about 0530 UTC on Saturday, 5th May, 2001, the IOTA (Islands on the Air) station was up almost continuously till about 0030 UTC on Monday, 7th May, 2001. With the ten operators who participated, this IOTA event operated four stations on phone and CW on various bands simultaneously.

Amidst a lot of weather uncertainties, the IOTA to AS096, The St. Mary's Island, was a grand success. The total count of logged QSOs crossed 3,500 in the less than 40 hours of effective operating time. Logs are still being sorted out and more statistics will soon be available. It is our desire to QSL every QSO logged. A well-planned event by the Manipal and the Mangalore hams, the IOTA was the first of its kind for all operators who participated. Hoping WPC's approval will come in on time, which it eventually did, other coordinating efforts began just a few days prior to the scheduled date.

Photo A. OM Prakash VU2JIX, operating one of the stations on AS096. Mur VU2MTT in the background, watches while VU2SBJ takes a break lying on the floor. (Photo by VU2RDQ)

Photo B. A view of one of the four stations on AS096. VU2JIX operating while SWL Nidhi lies down. (Photo by VU2RDQ)

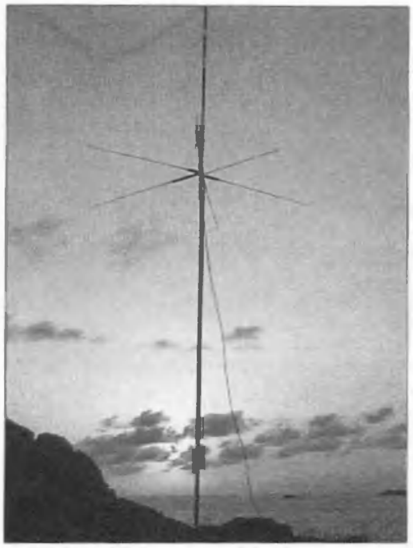

Photo C. A view of the Diamond CP6 vertical antenna during sunset in the background on AS096. (Photo by VU2RDQ)

The team that took part included Manikant VU2JRO, Bhat VU2NJN, Sri VU2SBJ, Gopi VU2GPH, and VU2MHC (MIT Ham Club, Manipal) from Manipal: and Mur VU2MTT, Chets VU3DMP, Pai VU2PAI, Prakash VU2JIX, Rohit VU2RDQ, and Sukanya VU2RDJ from Mangalore.

SWL Laxminidhi from Man- ipal and two others from the Mangalore Coast Guard also accompanied the team.

These were the 4 stations we eventually set up.

STATION 1: HF

RIG: Kenwood TS 850 S
ANT: 3-element 5-band yagi, Cushcraft MA5B (10/12/15/17/20) meters
CABLE: RG-213
MAST FOR ANT: 17 feet
BATTERY: 180 Ah lead acid
CHARGER: 35 VA solar panel
SHELTER: Pre-erected bamboo frame with woven coconut leaves and tarpaulin.
OPERATORS: VU2PAI, VU2MTT, VU3DMP, VU2RDQ

N.B.: The camp kitchen was also in the same shelter — now you know why there were so many operators in one place! The camp kitchen was operated by VU2RDJ.

STATION 2: HF

RIG: Yaesu FT-757
ANT1: 10m 3-el home-brew yagi
MAST1: 10 ft. GI pipe
CABLE: RG-213
ANT2: 15m 2-element home-brew yagi
MAST2: 17 feet AL
CABLE: RG-213
TUNER: Home-brew
BATTERY: 180 Ah lead acid
CHARGER: 35 VA solar panel
OPERATORS: VU3DMP, VU2MTT, VU2JIX, VU2RDQ
SHELTER: Home-brew — tarpaulin tent with bamboo supports.

STATION 3: HF

RIG: Icom IC-751
ANT1: Fritz 3-band (20/15/10) vertical antenna with mast in the water
MAST: 12 feet aluminum
CABLE1: RG-213
ANT2: Home-brew G5RV allband horizontally supported on coconut trees
CABLE2: RG-58
TUNER: Home-brew
BATTERY: 88 Ah lead acid
CHARGER: 35 VA solar panel
OPERATORS: VU2SBJ, VU2JRO, VU2NJN, VU2GPH, VU2JIX, VU2MTT, VU2PAI, VU3DMP, VU2RDQ, VU2RDJ
SHELTER: Home-brew — tarpaulin tent with bamboo supports.

STATION 4: HF

RIG: Icom IC- 725
ANT: Diamond CP6
MAST: 17 ft. aluminum
CABLE: RG 213
BATTERY: 180 Ah lead acid
CHARGER: 35 VA solar panel
OPERATOR: VU2MTT
SHELTER: Commercial dome tent

Logistics

This should give an idea of the enormous amount of luggage that was carried. The 6 lead acid batteries (2 extras) probably were the bulkiest items. A very useful sledge prepared by VU2RDQ was a boon to move the batteries. About 250 liters of drinking water, and another 50 liters for "other" purposes, came second in line in terms of bulk. Tarpaulins, bamboo staves for tents, aluminum masts, radio equipment, and antennas came in next. Due to indications of rain, adequate water proofing for equipment (worth our life for most of us), utensils for cooking, and food were the other components of the luggage that was carried.

Photo D. Unloading the stuff from the boat to the island. It took a good 40 minutes to get all the stuff out. (Photo by VU2RDQ)

Rain and a flat tire delayed our start by about 60 minutes. Eventually, after a quick breakfast specially arranged by VU2NJN at the wee hours of the morning at a hotel in Udupi, we reached Malpe and began unloading stuff from a mini truck and 3 other cars at about 7:45 a.m. (Saturday, 5th May).

It took about 30 minutes to load the boat, and a similar amount of time to unload after about 25 minutes of travel in the sea. It was drizzling and the sky was dark, so you can imagine the uncertainty in our minds. Fortunately, it was not windy. The boat people refuse to travel if it is windy.

After we landed on the island and unloaded all the stuff by using a human chain, it took us about 4 hours to get most of the things in place and to set up 2 stations on the island. Fortunately it stopped raining. (Later the temperature went up to as high as 42

Photo E. Setting up the Cushcraft MA5B for one of the stations. Seen in the picture are (left to right) VU2PAI, VU2JRO (face not seen), VU2NJN, VU2MTT (on the chair), VU2JIX, SWL Nidhi. (Photo by VU2RDQ)

Photo F. A view of the AS096, St. Mary's Island. This picture was used on the QSL card, too. (Photo by VU2SBJ)

Photo G. The entire AS096 team. Left to right: VU2MTT, VU2PAI, VU3DMP VU2JIX, SWL Nidhi, VU2NJN, VU2SBJ, VU2GPH, VU2JRO, VU2RDJ, VU2RDQ. (Photo by self-timer)

degrees C.) We were the only people on the island then.

The third and the fourth station came up subsequently. A very useful tip from K2KW encouraged us to install at least one vertical with the mast right in the sea water. You have got to see to believe how dramatically it improves the performance of the antenna. It was comparable to that of the other beams that were erected. For more details on the special performance of verticals in salt water, visit [http://www.k2kw.com/k5k/dxcomp.htm].

The propagation condition from St. Mary's Island was moderate overall with solar flux showing 165 points on Saturday and 160 points on Sunday. The peak was showing a downtrend in the coming days.

Ten meters was good on 5th May during the 12:00Z to 15:00Z with a huge pileup, usually from Europe. There were stations from N. America, S. America, JA, VKs coming through pretty well. The condition on 15 meters was exceptionally good and the pileup from Europe was tremendous during 17:00Z to 20:00Z. Also, some stations from N. America/S. America were strong on 15 meters. The 20/17/12 meter band was not encouraging on 5th May, but we could log maximum stations during the peak time on 12 meters on 6th May. 20 meters improved on 6th May with stations from Europe, N. America, S. America coming through pretty well. 17 meters was quite moderate. We did our best to log maximum QSOs with optimum band propagation and minimum operating time.

We stopped operations early in the morning on the 7th (Monday). The specially hired boat was to pick us up at 7 a.m. It arrived dot on time. We were almost done with disassembling all the stations and the other stuff. It's amazing how much less time it takes to pull down a station as compared to setting it up! It took us less than 90 minutes to get all the stuff back to one place. We reached the shore of Malpe at about 9 a.m. A promisingly busy day at work for each of us looked certain. Nevertheless, it was worth every minute of the fun we had on AS096.

The small effort to publicize the IOTA event on the Web paid off well. Though the event was confirmed just a few days prior to the event after WPC's letters came in, the good response on the band made all efforts towards our maiden IOTA very worthwhile.

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Agenda KS 66930

Bare Bones Battery Booster

A good project — as long as you understand the dangers and limitations.

Back in the mid-1970s, I came across a circuit for a very simple constant current charger which was a capacitor in series with one side of the AC power line to a bridge rectifier with the output of the bridge going to the battery terminals. The capacitor value limited the AC current by its reactance value. I made mine to pass around 40 mA. I used it for several years without an isolation transformer. They are not cheap.

Recently I decided to change the design a little and not only make it safe but also give four different current outputs for batteries with different ampere-hour ratings. A ten percent charge rate is standard and will not damage a battery if left on charge for over 12 hours.

I had all the parts on hand in my junk box supply. There are just a few parts needed and it is a good project to do in your spare time. You can make your own layout and customize it to your needs. One neat thing about this charger is that you can short the output leads and the current will still be limited. I used a surplus 0–150 mA meter mounted on the project box to show the actual current. You don't need the meter, but you should mount a couple of test lead jacks on the box to use your VOM current function to watch the current when trying different capacitors. Leave the output shorted while testing capacitors. After selection, you may replace the VOM with a jumper if desired. Also, you may want to add a power switch and an indicator light.

The battery voltage under charge is not important as long as it is under 20 volts. The charging current *is* important. The charger output voltage drops to the battery level during charge unless the battery has an open cell, in which case no current will flow. Open circuit voltage is about 25 volts. Use Mylar capacitors with a voltage rating of at least 200 volts DC. Have fun. NØGJ.

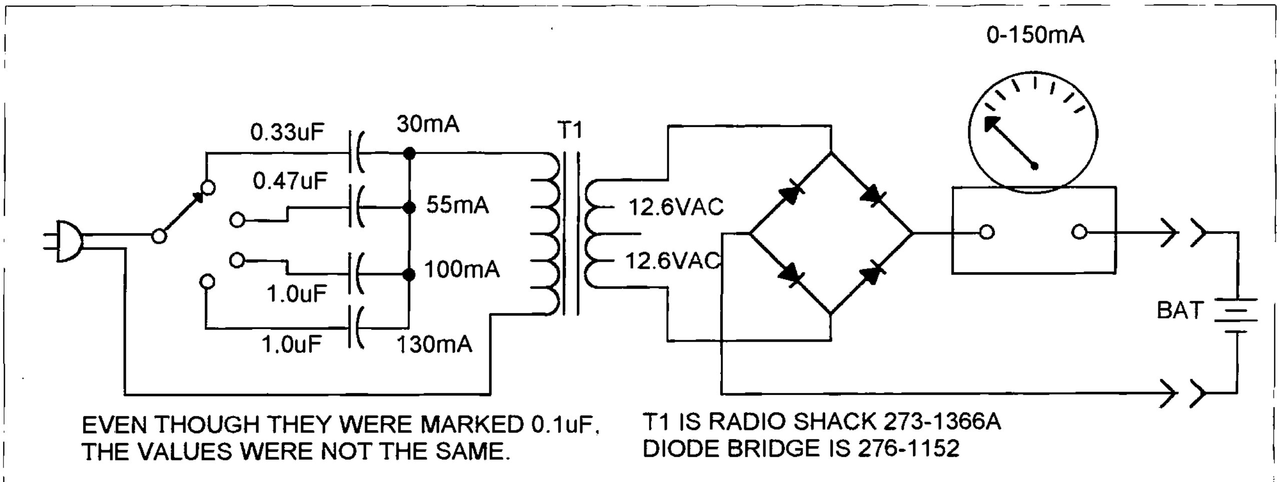

Fig. 1. Battery booster circuit.

Ken Glanzer K7GCO
202 S. 124th
Seattle WA 98168

RF Inferno

Meet the new Raibeam antennas.

It's the beam of the future and it can be on your tower today. This amazing new design is the development of Chuck Smith WA7RAI, who "just wanted to be competitive while DXing from a small city lot."

Dick Adcock W4GL was the earliest pioneer of this, in the late '40s, with a 3-element all-driven array that he advertised in *QST* for one month. Robert Martinez W6PU was a pioneer in 1980 with dual-driven quads, which he introduced to the amateur radio community via an article in the December 1983 issue of *CQ*. He is still using this beam and it has no competition. Al Laun K3ZO followed up about a year later with an article in *CQ*, trying to prove W6PU wrong, and couldn't. K3ZO is a contest winner with his version. Antenna Mart has a version of this quad also. All driven elements up to about three or four, and then "parasitic elements," appear to be the state-of-the-art. Even just two driven elements kick a lot of butt.

Photo A. The 2x2-element and 5-element Raibeams came neatly wrapped in one box. One 2-element is unwrapped. The bag of hardware and tools I added are shown. These were assembled and installed in one afternoon.

What makes this design so different? The typical yagi has a single dipole driven element (DE) that accepts power from the feedline. A dipole's free space pattern is donut-shaped with a gain of approximately 2.2 dB as referenced to a theoretical isotropic source (this gain is expressed as dBi). Thus 2.2 dBi is generally accepted as a 0 dB reference for all antennas where their gain is expressed as dBd. In the case of the yagi, the driven element excites one or more parasitic elements, i.e., reflector and/or director(s), that change the donut pattern into a cardioid pattern, with its main lobe extending forward and a null towards the rear (the difference between these two extremes is expressed as the front to back ratio, F/B). Parasitic elements, to be effective, must be a certain length and spacing — the specifics being dependent upon their function. Yagis have been the standard beam antenna for years, but they must rely solely on parasitic elements that absorb and re-radiate RF energy, to affect and reinforce the

radiation of energy from the DE in the desired manner. Yagis (and quads), do a great job but all parasitic arrays of this type have limitations regarding maximum gain and best possible pattern, not to mention that their maximum gain and best F/B cannot occur simultaneously. The reflector and directors are "parasites on RF welfare," hence the name "parasitics."

A phased 2-element beam called the "ZL Special" was featured in a series of articles in the NZART (New Zealand Association of Radio Transmitters) publication, *Break In*, in the late 1940s. This beam was constructed using tubular folded dipole elements at a spacing of 0.125 wavelength, and despite numerous phasing line variations, it remained somewhat quirky and difficult to match to a feedline. Despite these difficulties, one of the versions worked quite well — actually, very well. I played with that myself in 1953. Obtaining the proper current distribution by employing a phasing line of the right length and impedance can be a very tricky procedure — and successful results have evaded many who tried. A Swiss ham later developed a somewhat successful plumber's delight version of it known as the "HB9CV."

In the 1980s, Chuck, after using and studying the ZL Special, began developing his own improvements which utilized closer-than-normal element spacing, increased phasing line delay, and a means to properly terminate the phase/delay line into each element. Since the impedance of both elements are fairly low due to their high degree of mutual coupling, the current flowing in them is quite high. Chuck soon developed a unique element bracket designed specifically to reduce high-current losses.

The Raibeam's driven element spacing is about 0.1 wavelength, which is much closer than the typical 0.125 wavelength or greater that is generally used with 180 degree phased elements. At this closer spacing, and higher degree of coupling, the driven elements can become — under certain sets of conditions — critically coupled, a state in which their currents become equal in amplitude. Chuck has a patent on this unique design as it uses this critical coupling to an advantage, resulting in increased gain and a better overall pattern (excellent F/B).

Photo B. The 6m 5-element Raibeam above the 2x2 phase-stacked vertically polarized Raibeams.

Upon realizing that he had also developed an ideal "engine" for a reflectorless beam, Chuck soon married his design to parasitic directors. In 1995, he formed a company called Raibeam and then started selling mon- oband beams for HF and 6m. It wasn't long before he discovered the best way to interlace the drivers, and thus his triband and dual-band beams were born. The 2-element tribander weighs 36 pounds and the dual-bander weighs 20 pounds. Rai- beam has up to 4 elements on 20-10m. The 2 driven elements' "gain cell," as I call it, have an RF running start with gain and F/B before directors are added for more gain and the F/B is retained. This is not so with a yagi DE, where its dipole vertical pattern is a circle with "0" gain.

After hearing a lot of good things about these beams, I decided to see for myself if there was anything to it. I should mention that I was also eager to experiment with stacking the 2-element ones. And, yes, I did pay full price for them, and on a retirement income as well.

All 3–6m beams came neatly wrapped in plastic wrap. After checking the packing lists for missing parts (there were none), their assembly was easy and straightforward. I was able to assemble all three beams in one afternoon. Their light weight allowed

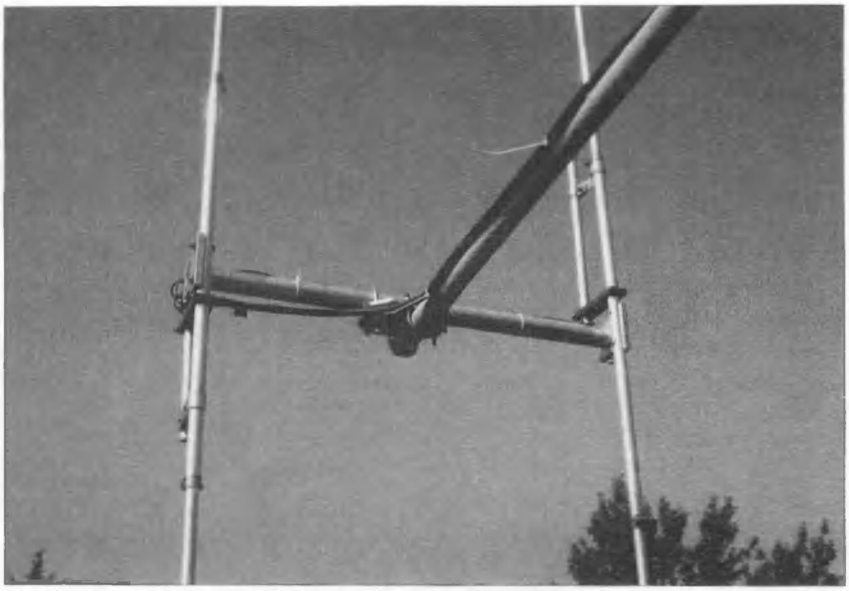

Photo C. 2-element 6m Raibeam. Both elements are driven, have very good patterns, weigh just 3 pounds each.

me to install the beams all by myself in a very short time, although I do have the advantage of a very useful wooden platform on the tower that allows me to do antenna work very quickly. Having close to 60 years of tower experience does tend to help — hi!

Photo D. 5- over 2-element 6m Raibeams with 1/2-wave vertical on top used as a listening antenna. These two beams can be selected individually or both together in phase. Various configurations are being tried to obtain different angles of radiation individually or phased together, or differences in polarization to create different angles of radiation to compensate for polarization shift.

There were no compromises in the quality of the materials and construction of all three beams despite their ease of assembly. I was impressed to see that an element tubing thickness of 0.058" was also used for the 0.625" diameter tips. The boom-to-element mounts are machined from thick aluminum flats that clamp on the boom, then secured with both a clamping bolt and pointed set screws. Each element sits in a finely milled saddle and is secured by two bolts. Tubing clamps are used at the telescoped tubing joints (all hardware is stainless steel), and a thick aluminum mast-to-boom plate is included. Conductive grease is also supplied for the element joints to prevent corrosion, and for coating the threads of the stainless steel bolts, nuts, hose clamps, and U-bolts to prevent seizing. It's obvious that these beams were designed to take a lot of ice loading, very strong wind, and should be able to stay up for a long time without the need of maintenance.

The 5-element 6m beam is on a 23.5-ft. boom (1.125 wavelength), and from on-air tests, I have concluded that its pattern is sharper than the 7-element I once had with a 0.15 wavelength longer boom. That caught my immediate attention! I found it sometimes necessary to ask exactly where a local 6m station was located. If I were just 30 degrees off, I'd lose them in the noise. I use speeded up prop pitch motors as rotators to turn my beams, and the sudden signal strength change either way was dramatic. One station observed the sudden increase when I spun the beam on him and said "WOW! It was just like you'd suddenly moved down the street from me." With my previous 5-element 6m yagi — on a 16-ft. boom — I didn't have this effect at all. I can now hear differences in band noise as I rotate the beam, which I didn't hear before. It's not unusual to get 40–60 dB over S-9 reports in Seattle with just 100 W now.

The 2-element Raibeam weighs just 3 pounds and is on a 2.1-ft. boom, making them ideal for limited installations. I have both of the 2-element 6m beams vertically polarized, and stacked in phase on a horizontal fiberglass boom 10 feet below the 5-element horizontal beam. The short boom 2-element beams need only about 1/2-wave spacing for a 2.9 dB (maximum) additional stacking gain.

Vertically polarized beams will generally give a lower angle of radiation than a horizontal one at the same height, but I wanted to determine if the wide horizontal pattern, typical of 2-element beams, would perhaps be beneficial by filling the holes or areas not covered by the various lobe angles typical of a single horizontal antenna

that is several wavelengths above ground.

Another reason I wished to experiment with the 2x2 vertical array is that I have heard stations using horizontally stacked vertically polarized beams on 6m where the user claimed great success with them. Since they didn't have a horizontal reference beam, it couldn't be determined if a real advantage (or disadvantage) over a horizontally polarized beam at the same height did exist.

Another big advantage when switching to the vertically polarized beams is often the reduction of QSB due to polarization shift. You are at the mercy of it with only one polarization. This concept is applicable on 1.8–445 MHz and few use it — I sure do.

I have been able to run a few comparison tests, but so far, I've seen too few and no long openings to really come up with any real definitive data. Preliminary results suggest that the vertically polarized 2x2 array appears to have similar receive abilities when compared to the horizontal 5-element beam, but the horizontal 5-element beam was superior on transmit most of the time so far, more than the gain difference. Further tests may provide enough information to verify this phenomenon and perhaps find an explanation as to why this may be so. I will be using higher-gain beams vertically polarized.

In conclusion, the Raibeam's gain, F/B, and front-to-side ratios are very good. Maximum gain and F/B are never obtained simultaneously with yagis and quads, but there is ample evidence to suggest, that with the Raibeam's critically coupled driven elements, this is not only possible, it is more than likely the case. The 5-element 6m Raibeam has the best gain and F/B/Side of any antenna I've ever used in over 60 years of using beams. I found that with only 100 W I have a lot of "RF clout." If and when I didn't get a station on the first call, I would check and see if it was pointed at them, and in most cases, it wasn't.

When the band was open, there would be a lot of other local stations working the opening before and after me — which is normal. But what wasn't normal was when the band was about dead — I could still be working the weak stations, but no other local stations would be calling them. This happens routinely which implies that the other locals just aren't hearing them. Surprisingly, I have also worked scatter — over the Cascade Mountains into Yakima — KC7FFK. When a friend calls you on the phone to verify that you are really in contact with a station — and not faking it — it is a tip-off of very good antenna performance!

I can certainly believe Raibeam's claim of higher gain and lower noise reception. The matching arms are "DC shorts" across the feedpoints, which is not the case with a gamma and its series capacitor. There is nothing that will get a salty old antenna man more excited than a new design that has features and performance that the others don't!

I highly recommend this superb line of antennas [Raibeam, 5658 W. Alice, Glendale AZ 85302; 1 (800) 530-1913].

If you'd like to know more about them, check out their excellent Web site at [http://www.raibeam.com].

One photo shows the 6m 5-element Raibeam above the 2x2 phase-stacked vertically polarized Raibeams. I can select either or both in phase. On top is a 1/2-wave vertical antenna I use for monitoring the call frequencies of 50.110, 50.125 MHz, and beacon activity. A "monitoring antenna" is even more of a necessity using beams with very good F/B/Side on any band. In the near future, I plan on experimenting with stacked halos on top for monitoring also.

Get a Raibeam and create your own "bragging rights"!

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VOM Primer

This overview is helpful for beginners and old-timers alike.

The VOM, volt-ohm-milliammeter, is the workhorse of the electronic workbench. How it works and why it works isn't important as long as it works. But the how and why are important if we are to know its limitations.

The galvanometer is the core of the instrument. It's the thing that indicates what's being measured. The galvanometer's operation depends on the forces applied to conductors in a magnetic field. In the usual form, a coil of wire with a pointer attached is suspended in a magnetic field and a current is established in the coil: The forces thus produced on the coil deflect it from its position of rest and the amount of deflection serves as a measure of the current in the coil. This is the operating principle of the d'Arsonval galvanometer (named after the French physicist, Arsene d'Arsonval) used in the measurement of small currents, as well as most voltmeters and ohmmeters.

Meters are rated by the current needed to produce their full scale deflection. For example, a 1 mA meter will have full scale deflection when the current in the meter is I mA; a 50 μA meter will have full scale deflection when the current in the meter is 50 μA.

The basic meter is a coil placed in the field of a permanent magnet. The coil is held at rest with a small spring and a needle is attached to the coil to sweep the needle across the meter face to indicate the current in the coil. The coil is free to rotate in the magnetic field.

The magnetic field can be disturbed by nearby magnets or even magnetic material and affect the readings. Most meters, but not all, are shielded to isolate them from their surroundings.

There are many ways to abuse a meter: Mechanical shocks can dislodge the coil from its bearings. Strong overloads can bend the needle at the peg. Meters with bent needles are not uncommon. I have seen meters that have been overloaded until the coil's insulation has smoked. The faces are then tan with black numbers.

Most meters have a short across their terminals when they are not in use. The short across the meter damps out the effects of sudden movement of the meter. If the coil is moved with respect to the magnet, a current is induced in the coil and a counterforce is produced. The short is not intended to protect against stray voltages that might be encountered.

An unknown meter can be mechanically tested by rotating it in the plane of the meter face. If the needle moves, the coil (form) is in its bearings, and if it returns to rest immediately, the coil is probably intact. Of course this kind of test doesn't tell anything about the electrical condition of the meter, only the mechanical.

Two characteristics of a basic meter are the resistance of the coil and the current required for full scale deflection. As you might guess, the resistance of the movement differs for different sensitivities. Typically the voltage across the coil is either 25 mV or 50 mV. Most 1 mA movements are about 25 or 30 ohms. More sensitive movements have a resistance in the range of 1,000 or 2,000 ohms. The current is the critical factor.

To make an ammeter requires a shunt across the basic meter. For this, the meter's resistance R_m must be known. If it is required to increase the full scale deflection from 1 mA to 10 mA, a 9 mA shunt must be placed across the meter. The voltage across the meter and across the shunt is $R_m \times I_{fs}$. The current in the shunt is $R_m \times I_{fs}/R_s$. The ratio of the shunt resistance to meter resistance is $R_s/R_m = I_{fs}/I_s$. A 30-ohm R_m and a 1 mA movement needs a 3.333Ω shunt to increase the full scale deflection to 10 mA.

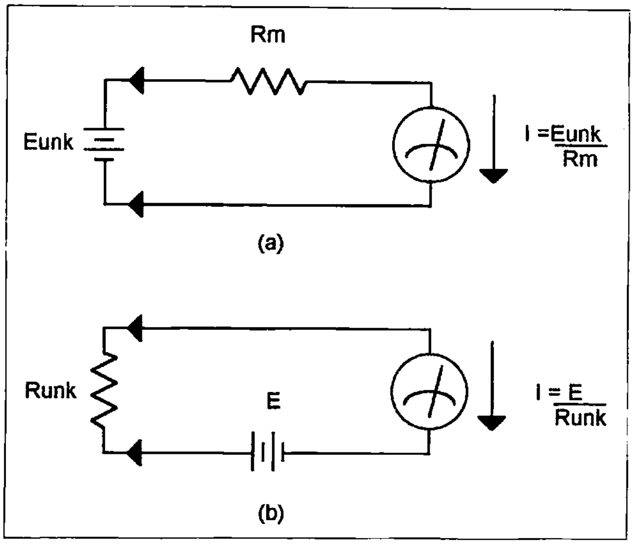

Fig. 1. (a) A current meter can measure voltage. (b) A current meter can measure resistance.

The unavoidable voltage drop across the meter is a limitation in very low current or very sensitive measurements. Usually we ignore the voltage drop across the current meter and ignore the few millivolts dropped across the meter. But the limitation should be recognized and evaluated for the particular case.

To make a voltmeter, a multiplier resistance is placed in series with the movement to limit the current. A multiplier resistance of 3k would limit the current from a 3-volt source to 1 mA. A multiplier resistance of 60k would limit the current from a 3-volt source to 50 μA. The sensitivity of a voltmeter is often expressed in terms of ohms per volt.

The ohms per volt is just the reciprocal of the full scale meter current. A voltmeter with a 1 mA movement has a sensitivity of 1k ohms per volt and on a 3-volt scale loads the circuit under test with 3k. A 50 μA movement has a sensitivity of 20k ohms per volt and a 3-volt scale loads the circuit with 60k. Most voltmeters indicate the ohms per volt on the face of the meter. We often ignore the loading imposed by the voltmeter, but the extra loading can upset a high impedance circuit. The meter's sensitivity indicates the loading that can be expected. For example, a 20k ohms per volt meter on the 100-volt scale loads the circuit with 2 megohms, but on the 3-volt scale the loading is 60k.

While the meter indicates current, the scale can be calibrated in anything from VUs to inches of water. So don't be put off by the scale; the meter works the same. It measures a current.

To make an ohmmeter requires a current meter and a known voltage of some sort; a single dry cell of 1.5 volts is fine for lower resistances, but 9-volt or even 30-volt batteries are used in some instruments. The voltage is applied to the unknown resistor and the current measured. The unknown resistance is $E/I_{indicated}$.

Since the ohmmeter's battery voltage changes with use and time, a zeroing pot is included to set the full scale deflcction. The pot is adjusted so the meter indicates full scale when the leads are shorted (the unknown resistance is zero).

Most VOMs also read AC volts. To

Continued on page 59

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Ye Olde Fishpole Vertical

Some things never change — thankfully.

Recently I have noticed the quest for portable antennas among our QRPers, and I remember the many times when I was in a situation where a sky wire couldn't be tolerated.

Over the years I have used small portable antennas, mini loops, helicoids, and hotel room window frames. All worked for me reasonably well, but I notice the trend these days is more for hiking into the hidden valleys, mountains, and personal Shangri-La's.

I've been an amateur radio operator for a number of years now, and I've experimented with helicoids, end fed dipoles, and Vertical Radiating Dipoles (VRD), which I have found worked quite good from earth ground, but not from on top of buildings. I figured that I could come up with a small package that should perform reasonably well under the above conditions.

I knew that an antenna requires capacitance and inductance. From the formulas contained within the *ARRL Handbook* I also knew that it wouldn't take very much to accomplish an extremely small antenna whose weight would be ideal for backpacking. Experience gained by the use of fiberglass components — fishing poles — for rotatable dipoles and two-element beams made me yank out my trusty old notebook, and peruse through the hundreds of schematics and antenna designs that I have.

***Photo A.** Frank in the Sierra Nevadas, working DX with a simple portable vertical.*

Suddenly my attention was focused on a mini 20-meter two-element beam. It was quite efficient, although the beam pattern was quite narrow, making the use of a rotator a necessity. Once the other station's signal was peaked up, it was no problem making a contact with 1 through 5 watts of RF power.

I also realized that I stumbled upon this design by first constructing one element and making it resonate to my frequency of choice, before making the other three elements. Armed with that data, it didn't take me but a few minutes to construct a vertical that could be collapsed down to a 28-inch package, and weighed in at just a few ounces.

This is one that could be used from a canoe or rowboat, held up by clamps, and with the radials running around the gunnels. Don't forget the Jolly Roger. Or from a hotel balcony, and — yes — from the fender of your vehicle if that is how you are backpacking. One that wouldn't attract the attention of the local Park Ranger, who more than likely will be thumbing through his handbook looking for a clause that mentions something about potential lightning hazards. You could even slip this antenna into a PVC tube with a mock wooden TV antenna at the top,

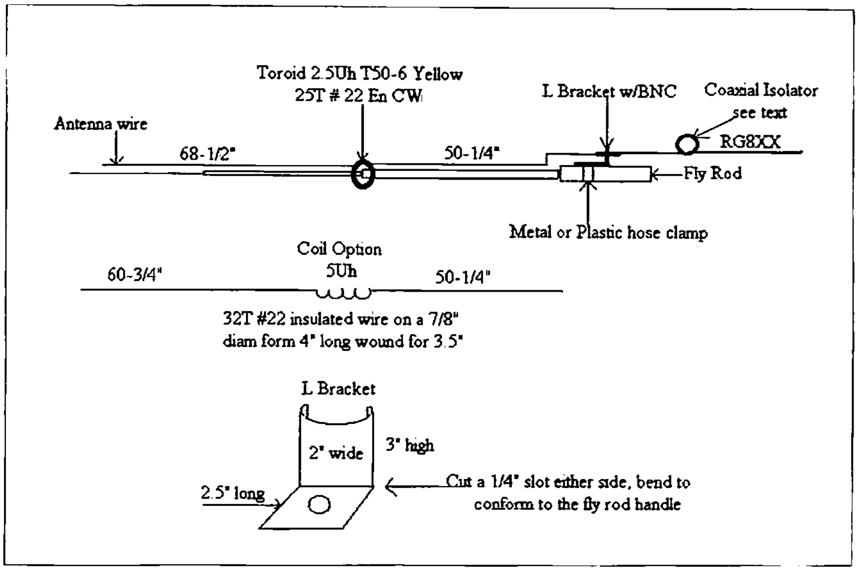

Fig. 1. Simple QRP vertical.

and use it as a vertical dipole. Don't forget to silver-paint the tiny UHF TV antenna.

The fly rod that I now have has been painted with camouflage green paint, and a good coat of varnish for a special application. It is now almost invisible in the bush.

The schematic shows that the antenna wire uses a fly rod to maintain its integrity. Simple fly rods that are 11 or 12 feet in length are rather cheap these days. Deviating from the norm of using air core coils, I used a simple ring core, which fits on the rod's frame rather nicely, and is quite small and easy to slide off for removal when you fold up the fly rod. When winding a ring core, make sure that you wind it for only 80% of the ring; if that is not feasible, then you would have to go to the next larger core, or use a smaller-diameter wire. Right! If there are any doubts about these devices, please refer to Chapter 6 of the *ARRL Handbook* and scroll down for the area of interest.

I used the yellow core series since I have them on hand. Generally these are not ideal for wideband applications, but they are suitable for our needs in the area of from 2 to 50 MHz, with the 6 material being more temperature-stable.

If anything, I hope that this will stimulate your interest for further research and experimentation. There is no telling

Continued on page 34

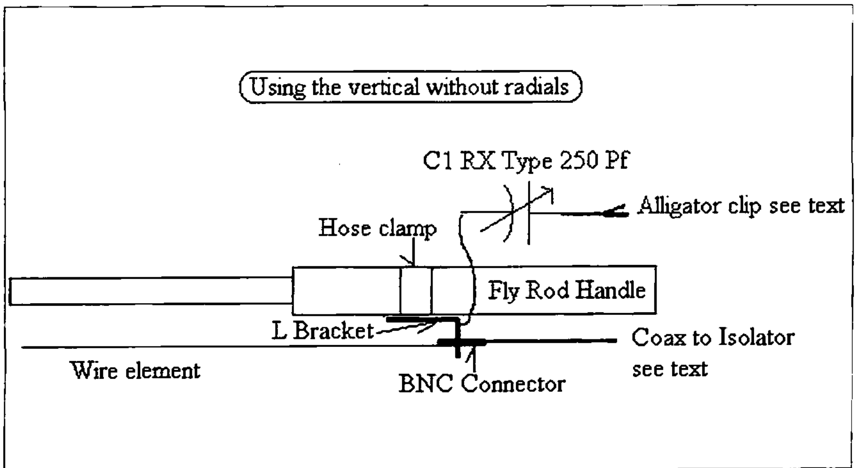

Fig. 2. Using QRP vertical without radials.

Ye Olde Fishpole Vertical

continued from page 33

what you may come up with, and I will be looking forward to your articles.

An option for an airwound coil is also provided. You can accomplish this by using PVC pipe 4" long by 7/8" diameter. Close-wind 32 turns of #24 insulated audio wire for 3.5 inches, approximating 5 µH; shim or glue into place. The coil wire and element wire in this case can be one continuous piece.

Constructing these antennas indoors is fine, but adjust them outdoors. Go out in the yard or to a city park, and prune for resonance. Make sure that you are not above a sewer pipe, or beneath power lines.

The lengths indicated in the schematics may put you well below 14 MHz, perhaps more like 13 or so. Just prune the tip 1/4 inch at a time, and you will find that your resonance point will simply pin the analyzer meter clear down to zero. Don't cut any excess from the fly rod — you may want to try something else later.

Make sure that you make an isolator out of the coax. This is done by curling a six-inch diameter coil composed of 6 turns at the base of the antenna, and tie-wrapping it in place. This will isolate the line from the antenna. This is very important, especially when using from a balcony or permanent site.

I usually don't snip any wire. I just curl it up into a small ball, and tape or rubber band it in place. Rule of thumb with all antennas: The higher up in the clear, the elements will be longer. Closer to ground or metal, the shorter the elements will be.

You will find that tuning under the most severe conditions, like on a balcony surrounded by a metal railing, and being close to a wall, will make the resonance points of the elements shorter. The tip, around 44 inches, and the radial, 158 inches. So when embarking on a field trip less all the close density factors, then you will tune it up for resonance for its particular environment. That's why I say don't cut the elements, just roll them up, or just tune for resonance in the field, and leave the elements for that type of situation.

I mated the handle of the pole with a 3-foot piece of PVC pipe, and extended the radials out in GP fashion, using plastic tent stakes to hold them in place. Another alternative is to use a small camera tripod. I prefer to use a metal stake in the bottom of the PVC so that it can be forced into the earth, usually at about a 30-degree angle with the tip of the fly rod pointed in the direction of choice. It seems to me that an endfire is accomplished with these little antennas, that is, when the radials are placed 180 degrees from the tilt, and my first contact like this, as I recall, was a contact between Hawaii, and Seoul, Korea with only 5 watts.

On one model I used a car whip antenna for the tip element, but of course on a heavier model fly rod that permitted me to adjust the length of the whip for resonance, and even allowed tuning up to 15 meters. Radio Shack now has these in a 72-inch length. Wish that I had a couple of them while experimenting for my helicoid article back in May '94 for *73*. This method also can be prearranged with the wire element, by marking a spot on the fly rod, simply coiling the wire up with two fingers, and holding it in place with a rubber band. Yes! Coiling the wire up nulls out the last resonance point, and permits selecting another resonant point — no need to snip!

If the acquisition of a fly rod is a problem, just tie a piece of fishing line

on the tip, and hoist it up on a bush. Tilt the bottom end for a direction, and be sure that it is not so high as to permit the proper placement of the radials on the ground or on stakes.

Portable operations are mainly being at the right place at the right time, tenacity, and the ability to listen through the noise level for those elusive distance stations, which will bring you your fair share of the prize. My old logs are full of contacts with stations using weak signal applications and ham sticks, window frames, or a wire thrown out the window.

Using the vertical without radials

C1 is a receiver variable capacitor. **Fig. 2**. The one that I used was 250Pf, about 2 inches long by 1 1/4 inch wide. I mounted it within a pill bottle, then attached two short leads with alligator clips on them. One goes to the cap's hot side, and the other goes to the cap's ground side. The pill bottle containing the variable cap can be held in place with a plastic hose clamp.

The antenna is placed in it's area for operation. With the long radials, determine the tip end element of the fly rod for resonance. When resonance is accomplished disconnect the long radials, and connect the alligator clip from the ground side to the L bracket radial ground screw. Now connect the hot end of the cap with the clip to perhaps a radiator, balustrad, roof ladder, or even a vehicle ground.

Part	Description
Lightweight fly rod	At least 11 feet long
Toroidal core	Yellow, T50-6
Dual insulated audio cable	20 feet #24
Enamel wire	2 feet #22
Option air core coil	4" x 7/8" PVC
Connector	BNC or PL-259
Mini coax, part of balun	25 feet RG-8X
Angle bracket aluminum	Scrap, cut to schematic specs
Variable receiver-type capacitor	250 pF, see text
Knob	For capacitor
Alligator clips	2 each
Patience & tenacity	1 gallon

Table 1. Parts list.

You could start from scratch by just connecting C1 to a ground, and by reducing tip length, and C1 adjustment to obtain a resonance point, but the method in the paragraph above is much easier.

This will eliminate the lengthy radials on the apartment floor, or for any semi permanent location.

I used a 4 foot length of insulated wire to connect to a 20 foot spiral stairwell. Connect the rig end of the coax to an MFJ analyzer, then adjust C1 for a good healthy dip, then perhaps a slight adjustment of C1 when

Continued on page 59

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The Builder's Dozen

Uncommon uses for common stuff.

During my tenure as a "ham operator/builder," I've been able to construct many projects, some of which would have required expensive shop tools, equipment, etc., which I don't have and haven't the resources to buy. By using the common objects surrounding all of us, we can usually "make do" without many devices and yet accomplish our desired goal.

Here are a "Builder's Dozen" I have used throughout the years. Have you ever tried any of them? Or, do you have any other ones to send me?

1. While shopping with my XYL, I came across "plastic shoe shipping rods," used to hold the shape of the shoes during shipment. These are abut 10" long with a 2" bend on one end. One is in each shoe. Removing the bend portion leaves a long round rod, easily scored with a razor knife. Roll the rod along a flat surface while putting pressure on the knife. Snap the rod at the score. I use these as "spacers."

2. "A/B" boxes, used to shift data from one printer to another, make great project boxes. Some are plastic and are easily drilled and cut, while others are metal and require a new face and rear plate but are entirely usable for small projects. The price is usually very affordable at hamfests and flea markets.

3. Emery boards, used for trimming finger nails, are an excellent device for removing enamel coating from fine wire used to wind toroids and transformers. When the end of the emery board becomes too smooth to be effective, trim the end with shears and continue use.

4. Juice straws, from the little packages of "lunch box" style drinks, make an ideal "bobbin" for fine enamel-coated wire used to wind toroids and transformers. Cut the straw to about 2", and notch both ends to form a "vee" to hold the wire. Wind the wire on the length of the straw using the notches to hold the wire. Pass the entire "bobbin" through the toroid and unwind as necessary.

5. Coffee pot plastic. When I needed a source for clear or smoked plastic for a project face, I came across a broken coffee maker headed for the trash. The clear "water tank" provided a good source of tough, clear plastic which was easily cut to size, durable, and not scratched from use.

6. Speaker cloth to cover small units can be substituted with black felt (or your choice of color). Squares of felt can be purchased at the local sewing/cloth store for pennies.

7. Speaker grilles, the screen material used to cover the speaker hole, can be created from the bottom panel of VHS players, etc., that have ventilation holes stamped in them. Carefully measure and cut to size. Drill and paint to match the equipment.

8. Damaged paint on enclosures can be effectively covered using shelf contact paper. This product is sold in many stores in the housewares department, and comes in many colors including clear. Cut the product oversized, peel the protective backing and apply to the cabinet. Trim excess material for a finished appearance.

9. For a more permanent fix, use "metal tone" spray paint sold in most hardware stores. This paint dries with a "dimpled" texture and is great for covering a multitude of sins. It looks good too!

10. Need a "ground plane" of larger-than-normal size? Go to the craft store and purchase a roll of "Maid-o-Metal" copper tooling foil for about $10. Using contact cement, a disposable brush, and a suitable backing material (I used an old legal-size clipboard), adhere the copper to the backing. Roll the copper on the backing (I used a recently emptied glass beverage bottle) to remove bubbles, etc. The foil roll is 36" by 12", so there's lots of material left over for future projects. This much cheaper than purchased circuit board stock of the same size.

Continued on page 59

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IC-706 Goes to Heil

How to mate your Icom rig with an old Heil headset.

After winning an Icom 706 MKII at a recent hamfest, I decided now was the time to go mobile.

Mounting the rig in my Nissan Altima proved to be quite a problem. Car manufacturers certainly don't design the interior for mounting transceivers. After much frustration, and arguments with the XYL, the location was finalized. Now, mounting the antenna and running the coax and power leads caused a few headaches, but finally everything was in place.

A handheld mic doesn't lend itself very well to mobile operation, though. It's strictly a no-no as far as safety is concerned. I happened to have an old Heil headset — it would be ideal for operating VOX. However, since Icom uses electret microphone input, I had to figure out how to use my old headset.

After checking out the mic circuit, I decided to build a small preamp to drive the mic input. The voltage for the preamp is supplied from the mic connections of the Icom. It works so well that I decided to let others know how to use their Heil mics on the 706.

This circuit can be used with any other transceiver that uses the same type of input.

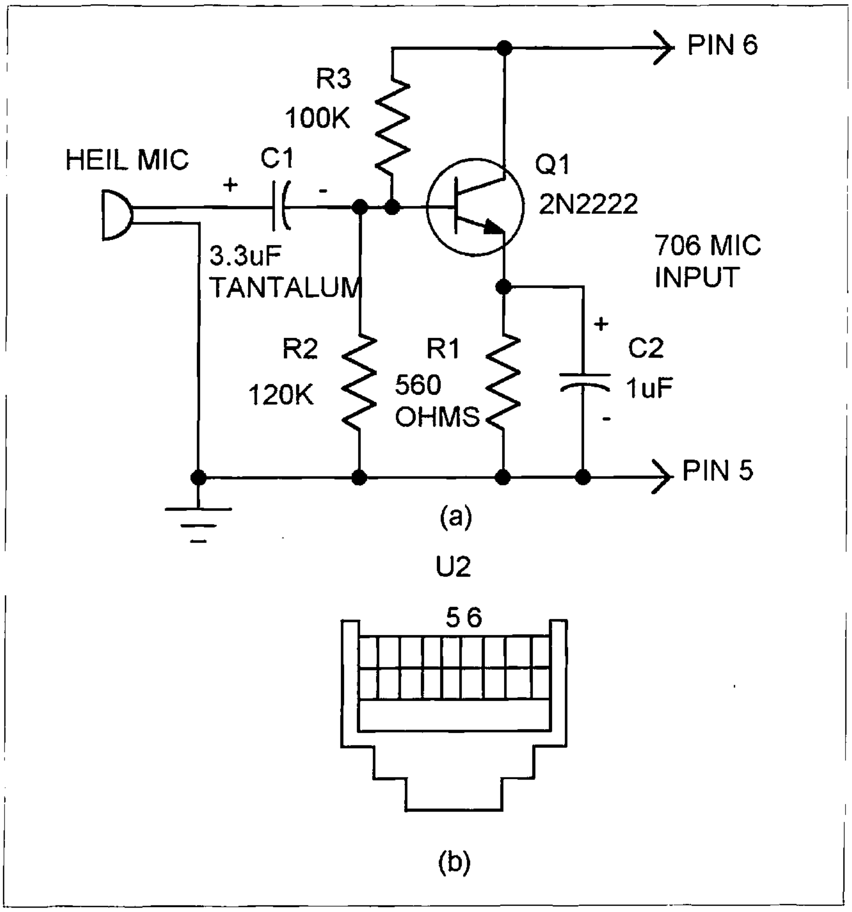

Fig. 1. (a) Preamp using NPN transistor and associated parts. (b) Rear view. 8-pin mic connector comes as an accessory.

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Helsinki or Buzz!

No-frills tickets meant an instant junket to OH-land for this G3.

For our Spring break this year, Jan and I decided to visit Helsinki. Part of the reason for the choice was that the "no frills" airline Buzz was offering two round-trip tickets for a total of £102, including taxes! The downside of this was that it meant flying from Stansted, which is about a 2.5-hour drive from home. This is the same as the flight time!

An exchange of E-mails with my good friend Jorma OH2KI led to a reservation in the city-center Helka Hotel and the offer of transport to and from the airport. It was not my intention to play radio at all during our visit, but maybe to meet up with a few of the local Finnish hams for a drink or a meal and to enjoy a few days sightseeing around the city. Also included was a possible day's trip across the Gulf of Finland to Tallinn, the capital of Estonia.

We left home on the morning of Saturday 21st April and dropped in at Potters Bar to see my sometime partner in crime Jim G3RTE, for a cup of coffee and to drop off three large boxes of QSL cards for him to deliver to the RSGB bureau. The flight from Stansted was a few minutes late, but Jorma was waiting for us at the Vantaa Airport arrivals gate. He then whisked us off to the Helka Hotel to deposit our luggage and then for a whistle stop tour of the city center, including a couple of much needed local beers.

Jorma was unable to join us for dinner that evening, so we found a restaurant and enjoyed an excellent bowl of mushroom soup followed by red deer en croute, washed down with a bottle of good red wine.

Next morning, Jan wanted to go to visit the house of Gallen-Kallela, the national artist of Finland. This is situated some distance to the west of the city center, and Jorma didn't know how to get there by road, so we had to get advice from the hotel, who said "take the number 4 tram to the end of its route and then follow the signs for a couple of kilometers." Having once got hopelessly lost on the Paris Metro, I am always a bit suspicious of public transport systems in strange cities, but we found the number 4 tram route without any difficulty and paid our fare. It wasn't until we began to see on our right-hand side buildings that we had already passed on our left-hand

Photo A. Left to right: Jorma OH2KI; author Phil G3SWH; Jan, G3SWH's XYL; Hans OH2EA.

side that I realized that we had actually reached the end of the tram route and started the return journey. We hopped off smartly and began to look for the signs to the Gallen-Kallela Museum. Nothing! This was a residential district and there were very few passersby to ask — and those didn't speak English. Fortunately, it was a beautiful sunny day, although the residue of the previous day's snow on the ground made it cold. After a long walk following the many vaguely waved arms indicating "that direction," we eventually found the museum and collapsed in dire need of a cup of coffee.

After an hour or so looking around the museum, we followed the lakeshore back to the spot where we should have got off the tram, and found an ice cream stall doing a roaring trade. There's something particularly delicious about mango-flavored ice cream! We then caught the tram back to the city center and a late lunch.

That evening, Jorma had arranged for us to meet up with Hans OH2EA and himself for a drink in the hotel bar. Hans is another ex-marine radio operator and we swapped many stories of our lives and experiences at sea. Unfortunately, Hans had a prior engagement and was not able to join us for dinner, so Jorma, Jan, and I went off to a very pleasant Chinese restaurant for a meal together, over which we discussed the possibility of a trip to Tallinn the following day. After dinner, we made a visit to the Nordic Jet Line ferry company's terminal and looked at the schedules. Our best option was to take a fast catamaran, which covered the 60-kilometer trip in one hour forty minutes and gave us six hours in Tallinn, before returning in the late afternoon. Strangely, the return fare increased if you wanted to stay longer!

Jorma then suddenly asked, "Do you know Vello ES1QD?" I replied. "I think I have worked him from just about every DX location where I have operated." Jorma immediately pulled out his mobile phone and called Vello, who readily agreed to meet us at the ferry terminal in Tallinn and show us around the city.

A taxi got us to the ferry terminal in good time. The weather was very cloudy and it was quite foggy during the voyage. Luckily, just before our arrival, the sun came out and it was another beautiful day. Vello was easily identifiable by the large "ES1QD" callsign badge on his chest. He took us off to see the Kadriorg Palace, which is a few kilometers outside the city and was built in the early 18th century by the Russian tsar Peter the Great. Apparently Peter himself actually laid three bricks! Vello works as an engineer for the local state broadcasting authority and explained that he had to go to work for a short time, so he took us to meet his son Tomas and explained that Tomas would look after us in his absence. Both Tomas and Vello speak excellent English.

Photo B. The author with Vello ES1QD outside the Kadriorg Palace.

The old town of Tallinn is situated on a hill in the heart of the city and is medieval in origin with narrow, cobbled streets. Severely neglected during the time of the Soviet occupation, much good-quality restoration has been completed and the town is well on its way to becoming one of the architectural gems of Europe.

After a whistle stop tour of the town, Tomas took us to an excellent restaurant for lunch before we headed back towards the ferry terminal, where we were able to say our farewells to Vello before the trip back to Helsinki.

Neither Hans nor Jorma were able to join us for dinner again that evening, but we arranged for Jorma to pick us up at the hotel the following evening to take us back to the airport. We found an excellent steak house for dinner, where an Estonian student served us! It was then back to the hotel bar for a nightcap.

Our last day was spent walking around the city center just seeing the sights, including a 15-minute ferry trip to the Soumenlinna fortress, dating from 1748, and built on six islands in front of the city. Again, the weather was kind to us and although it was cold, only about 5 degrees C, it was sufficiently bright and sunny for us to sit in a pavement cafe and drink beer.

Jorma collected us in the late afternoon as arranged, and the trip home was completely uneventful. Even the M25 ran smoothly, although it did start to rain as we entered the Bristol area!

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Beginner's PS Tester

This variable active load will do the trick.

You've just been told you've got a humming noise on your transmissions. Maybe you've even noticed a milder version of that on receive. Is your transceiver developing a problem, or is the filtering on your power supply failing? Here's an easy way to find out.

We're all familiar with the amplification capabilities of transistors: Turn it on a little by feeding the base junction, and the collector turns on a lot. We use it every day in the amplifiers in our radios. Here, we're applying this concept to a more basic principle. By applying a little voltage to the base through P1 in **Fig. 1,** the transistor starts to conduct. Instead of using the transistor's gain to amplify RF, though, we're using it to load an external power supply.

Before discussing actual operation, here are a few design considerations for our circuit. If we're going to test small to moderately sized power supplies, the 1-ampere transformer, rectifier, meter, and connectors available at Radio Shack will suffice. If you're going to test bigger supplies, then I recommend investigating heavier-duty components available through parts dealers like Digi-Key, Tri-State Electronics, Jameco, or Newark (my favorite four, but I'm sure that there are

Vendor	Fax	Telephone	Web Site	Address
Allied Electronics	Various	(800) 433-7500	alliedelec.com	7410 Pebble Dr., Ft. Worth TX 76118
DC Electronics	(602) 994-1707	(602) 945-7736	dckits.com	POB 3203, Scottsdale AZ 85271
Digi-Key Electronics	(218) 681-3380	(218) 681-6674	digi-key.com	701 Brooks Ave. S., Thief River Falls MN 56701
Jameco Electronics	(650) 592-2503	(800) 831-4242	jameco.com	1355 Shoreway Rd., Belmont CA 94002
Mouser Electronics	(817) 483-6899	(800) 346-6873	mouser.com	958 N. Main St., Mansfield TX 76063
Newark Electronics	(800) 718-1998	Various	newark.com	Various
Tri-State Electronics	(800) 255-0526	(847) 255-0600	Not specified	200 W. NW Highway, Mt. Prospect IL 60056

Table 1. Sources list.

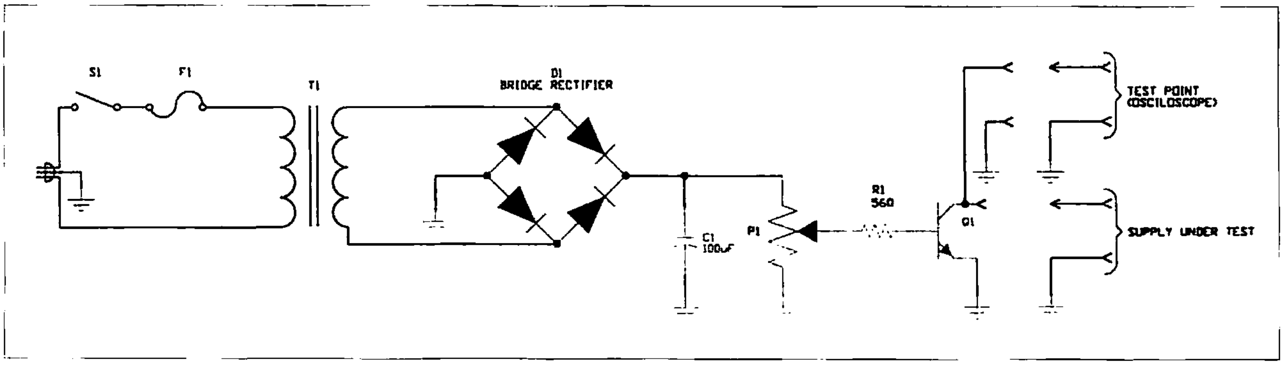

Fig. 1. Active load. Rolf E. Spies N9BRL had the original idea for this circuit, while son Klaus WB9YBM built the prototype.

others out there). Either way, though, the power transistor at Radio Shack (typically used for television sets, power supplies, and stereo equipment) will work. Be sure to heat-sink everything well—in this application, things will get warm!

I built my active load in a metal box — in this case, not to protect the inner workings from stray RF (as is the concern of my other projects), but rather for safety. We're dealing with 110 volts, and a grounded metal box is still the best protection between my fingers OUTside the box and the voltages INside the box! Also, as I said, in this application things will get warm. Metal enclosures can still not only withstand but dissipate heat better than the other options out there.

In actual operation, always be sure to start the potentiometer in the position that will turn the transistor off. This will avoid unexpected surprises. Also, I included a second set of jacks, or test points, that I could hook an oscilloscope to. This will allow me to monitor the purity of the DC of the power supply being tested, as I slowly increase the conduction of the active load. If you don't have an oscilloscope available, don't despair! There is another way to test for hum, and that's with an audio amplifier similar to the one discussed on page 26 of the November 1999 issue of *73*. Be sure your audio amplifier works properly (i.e., doesn't have hum of its own). Then, with a series capacitor in use (you don't want to feed DC into the input of your amplifier, so check to see if you need a series capacitor or if one is already built-in), hook up to the test points on the active load. Crank the volume on your audio amp, and if you don't hear a hum, your power supply is (at least close to) fine!

Part	Part Numbers					
	Digi-Key	Radio Shack	Tri-State	Allied Electronics	Jameco Electronics	DC Electronics
Transformer	HM520(12.6V 2.5A)	2731511B (12.6V 3A)	23V255 (12V 1A)	227-0103 (12V 4A)	29225 (12V 2A)	41FG010 (12.6V 1A)
	HM521 (12.6V 4A)	273-1352A (12.6V 1.2A)	23V415 (12V 2.0A)	227-0104 (12V 8A)	102120 (12V 4A)	41FG020 (12.6V 2A)
	HM522 (12.6V 6A)			2270144 (12V 16A)		41FG030 (12.6V 3A)
	HM523 (12.6V 8A)					
	HM524 (12.6V 10A)					
Meter	N/A	22-414 (500mA)	20-1118 (0–3A)	229-4110 (0–5A)	N/A	N/A
			20-1117 (0–10A)	229-4112 (0–10A)		
				229-4114 (0–20A)		
				229-4116 (0–30A)		
P1	Call	271-265 (25 ohm 3W)	P-20	Call	Call	Call
		271-1716 (50k 1/2W)				
Jacks	CBB104-ND	274-658	602	607-1132	N/A	N/A
Transistor	Call	276-2041	Call	Call	38324 (4A)	2N3715 (10A)
					40151 (8A)	2N3716 (10A)
					38308 (10A)	2N3055 (15A)
						2N3771 (3A)
						2N3772 (3A)
Power cord	Q106-ND	61-2853	17534	None found	173809	LE-2
Power switch	CKN1004-ND	275-634	35-000	870-9118	78523	5W104
Case	See catalog	270-2530	W-2F	None suitable found	None suitable found	MW10
Screws, 6-32	H355-ND	64-3012	F-504	None found	42446	632-375
Nuts, 6-32	H220-ND	64-3018	F-559	None found	42420	6HN
Washers (lock)	H240-ND	64-3022	MW-412	None found	106868	62C
Ground lug	N/A	64-3030	M-1118-06	839-2381	N/A	7312
Bridge rectifier	Similar to Radio Shack — see catalog	276-3146 (4A)	Similar to Radio Shack — see catalog	Similar to Radio Shack — see catalog	Similar to Radio Shack — see catalog	Similar to Radio Shack — see catalog
		276-1181 (6A)				
		276-1185 (25A)				

Table 2. Parts list.

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The Channel Master 11.7 to 12.2 GHz LNB: Conversion to 10.368 GHz

This month, let's cover finding a gem in the swapmeet circles and making a silk purse out of this sow's ear. During one of these adventures at my local swapmeet, I noticed some very interesting shapes in a large box. On further inspection, they turned out to be microwave dish downconverters from a Channel Master satellite converter system.

Now, this box was not an apple crate, but rather a big box full of antenna feeds, converters, and shrouds of plastic that covered the converters. There seemed to be little interest in these items, as no one else even came over while I was digging in to verify just what treasures lay inside. This box was about the size of a small refrigerator cut in half, about 3 feet cubed. Digging into the material, I determined that there were quite a number of downconverters of several different types in this box. From all observation, it looked like these converters had been collected from service calls or were units removed from customers who were changing to other TV satellite or cable TV services.

Well, thinking about the possible use for these items brought many ideas into play. The first consideration is the price one has to pay to bring this decision into fruition. Does it warrant a single purchase for experimentation, or does a bulk-buy scenario take effect? The premise of this thinking is that if one costs several dollars, do they get cheaper in unit price if the whole box is bought?

A cheap per-unit cost certainly has benefits, especially if you can use all of the material. Also, you have to consider the testing to determine the good-to-bad ratio — how much proves to be good or whether all units are bad and junk.

These and many other thoughts go through your head prior to asking the price from the seller. Just don't ask, "What do you want for this goldmine of microwave material?" A simpler query would be "How much?" for one item. Get a feel for the range of price negotiations first before going over the edge and paying too much for some untested devices. It's worth a try if you are interested in the lot of material and still being a part of the approved haggling at swapmeets. Haggling can be just as much fun as getting some treasure.

Well, in this instance I bought the whole box of plastic shrouds, converters, and antenna dish feeds for a modest to stiff price. At least it was a price I could walk away with knowing that if all items were defective, I would not take a bath in this deal. It's like playing poker: You have to pay to learn how to play the game. Just don't pay too much to learn how to play the game at swapmeets.

Going through the items at home, I removed the plastic shrouds and they became recycled material. The antenna dish feeds were cast aluminum. My grandchildren and I sorted out the aluminum from the plastic and I gave them the scrap metal price paid for the metal, 88 pounds of cast aluminum at 5 cents a pound. It was enough for each of them to get a Pokémon card set for their collection (my contribution), and a few dollars each for their piggy banks. A profitable event for the grandkids. I got the scrap removed and recovered the 11.7 to 12.2 GHz microwave downconverter, and we had a good time with something for all of us.

The materials recovered were the waveguide flange input connector and an "F" coax jack on the output. In actual operation, the converters are the units seen at the focus of a small microwave dish antenna, usually obscured by a plastic cover to give weather protection. What happens inside electronically is the same for all units, the only design differences being several RF stages (ranging from 2 to 4), the number of elements in the RF filters, and how descretely the units are constructed. By that, I mean are they individual parts or a great big monolithic chip that is unconvertible to other applications?

Well, all the units I picked up were discrete. The circuitry inside was the same except for the number of stages, types of RF filters, and the mixer and IF types of the amplifiers.

The circuitry flow goes like this: The converter converts 11.7 to 12.2 GHz, a 500 MHz TV band of microwave from a satellite as received and amplified by the dish antenna, further amplified by the internal RF amplifier stages, and delivered to an internal mixer to convert down to an IF frequency of something in the 1 to 1.5 GHz frequency range. To allow great operation these amplifiers are constructed to have a very low noise figure, in the 0.8 to 1.4 dB range — to say the least, that is HOT! A great performer! This signal is now amplified some 30 dBd by the dish antenna, and another 50 to 60 dB to the IF output is then connected by a section of coax cable to the top of your TV set. The converter on top of your TV set converts the incoming 1 to 1.5 GHz input to standard TV channels for reception.

Now, with a basketful of converters, I found large gray ones, small black units, a small number of white plastic-covered units, and a large number of small beige units. All the different-colored units look alike except for physical size. The gray units were about 6 inches long and looked to be the oldest design type. The white plastic units were smaller and were sealed with a potting compound, making opening difficult. The black

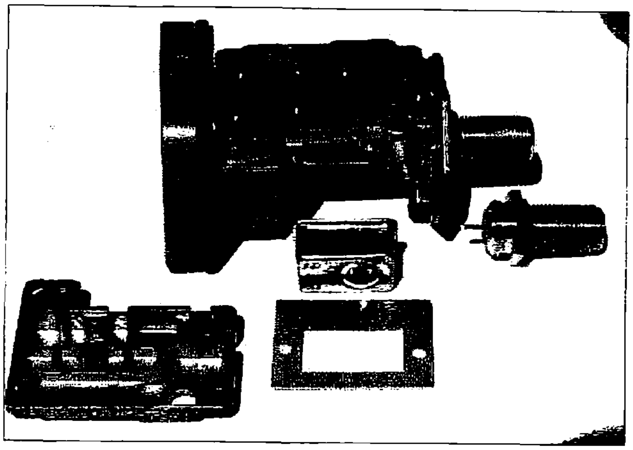

Photo A. The converter unit with the cover off. The RF housing plate is hollowed out, making small chambers for each part of the microwave circuitry to isolate parts of the circuit from other parts.

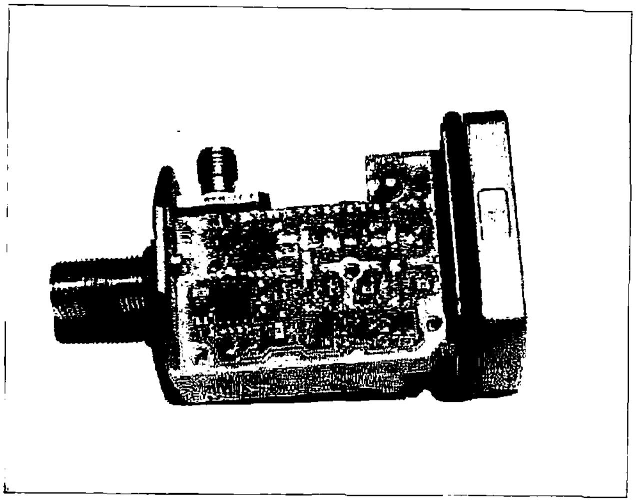

Photo B. SMA connection and RF board parts placement.

units were very high-tech internally and easy to open: Just remove the "F" connector nut on the rear of the unit and push against the "F" connector holding the case and the waveguide end, as it will pop out of the cover assembly. The beige units were opened last, and they proved to be the best of the batch: smallest in size, simple to open, and having very high-tech construction, with some very interesting circuitry yet to be discovered.

See **Photo A** for a photo of the unit opened. Depicted are the converter unit less cover, with the LO oscillator module and its cover hold-down plate, "F" connector, and a spare cover shield housing for the RF amplifier circuitry. As you can see, the RF housing plate is hollowed out, making small chambers for each part of the microwave circuitry to isolate one part of the circuit from another. This prevents what is called crosstalk from one part of a circuit to another, ensuring that the flow of amplification is as it should be and not a product of oscillations or feedback.

Now, what can be done to use these devices, as I am not going into satellite TV reception? Well, the base unit with some modification can be converted into a great low-noise dish feed amplifier for connection to a waveguide switch, or antenna directly. This would make full use of the RF LNA amplifier's low noise figure, allowing the RF amplifier to detect very weak signals in the 10 GHz amateur band after conversion. Benefits are low cost, easy modification, and low cost again, as if you mess up the conversion you can obtain another and give it a go again. With all the satellite systems being replaced and consumers upgrading systems everyday, there should be plenty of these units available at your local flea markets and swap meets.

The conversion and unit description

The LNB preamp input is a waveguide input, multistage minimum loss connection to the microwave antenna system. This allows for a very low noise front end as close as you can get to the antenna. This conversion from satellite LNB operation to amateur 10 GHz operation is quite easy. The benefits are many. First, the amplifier is pretested as a unit, with its internal DRO LO source mixing the 11.7 to 12.2 GHz down to the 1 to 1.5 GHz input to a converter located on your TV set for normal reception. These units operate with DC and IF (1 to 1.5 GHz) sharing the same coax from the LNB to this converter input. The voltage requirements are any voltage from +10 to about +24 volts. It normally shares the coax cable to the LNB coax center, positive and negative on the coax braid. There is diode polarity protection and a 7808 voltage regulator internal. Typical system noise figure is 0.8 to 1.2 dB.

Modification is quite easy. Remove the yellow cover by removing the type "F" connector nut. Slight pressure on the "F" connector will push out the LNB from the yellow case. On one side of the LNB there is a module that looks like a TTL crystal oscillator with a metal side cover held in place by two screws. Remove the two screws from the metal plate over the oscillator module. Then remove the five screws holding down the top cover over the microwave amp part of the LNB. Unsolder two pins connected to the PC board from the oscillator module, one on top and one on the underside of the LNB. This will remove the DRO microwave oscillator and mixer assembly. It is not required in the conversion. Notice that on the underside of the top metal cover plate there are two arches where two top pins of the DRO connect to the upper PC board where the LNA circuitry resides.

At the spot where you unsoldered the DRO oscillator (on the beige unit, this module looks like a metal TTL oscillator 4-pin CHIP like metal can), on the top PC board RF circuitry, is where an SMA connector will be attached. At this point (SMA connector connection) and the output of the 2nd stage amplifier there is a filter that is DC-isolated from the last stage amplifier and the point where the SMA connector connects (same place where you unsoldered the DRO oscillator/mixer). Remove all of the filter elements except a center width of copper on the PC board, for a new trace same width as filter traces. Cut away a suitable opening in this line to insert a 1 to 2 pF microwave chip capacitor to provide DC isolation between the last amp stage and the output.

The SMA connector can be mounted on a metal plate the same size as the one removed that held the DRO oscillator in place originally. Use the same mounting screw holes to mount this plate and attach a 2-hole SMA connector, being very careful to be accurate in positioning the connector on the strip-line circuit board trace. Allow clearance for the top cover with its arch, which should give clearance for the SMA pin to go under the cover plate hole. If need be, file away additional clearance in the underside shield plate for the LNA's SMA connector clearance to prevent shorting to ground. Another method of mounting the SMA connector is to solder the center pin directly on the output trace and push up the 2-hole connector to the flat surface on the LNA body to get as close as possible to the

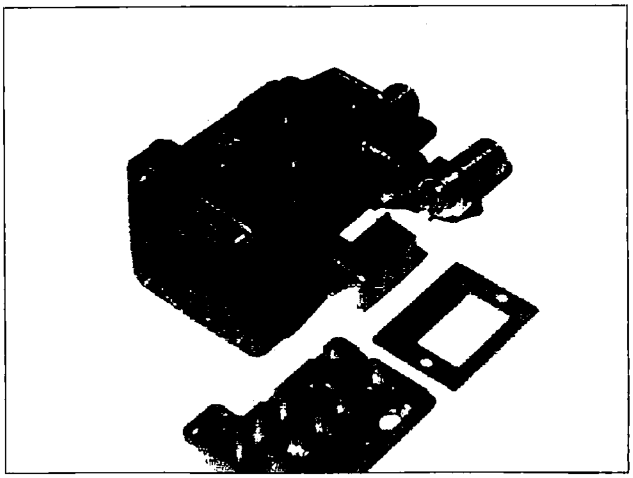

Photo C. Full side view of the Channel Master LNB.

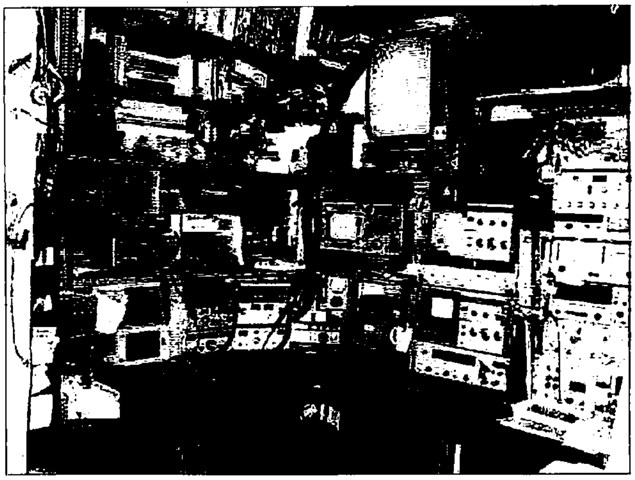

Photo D. The shop.

housing side. Solder the center SMA pin on the output trace that connects to the 1-2 pF chip capacitor. See **Photo B** for SMA connection and RF board location parts placement information.

Now, solder the ground part of the SMA connector to the ground foil on the edge of the PC board. Do not oversolder, as you need clearance for the shield cover to fit allowing the arch to clear the SMA center pin and still provide rigid mounting for the SMA connector. It's not as rigid as the mounting plate scheme, but it's an alternative to use in your modification options. Last, remove the type "F" output connector and replace it with a feedthrough capacitor of miniature size, and solder to the trace where the "F" connector was unsoldered. This will now be the new +12 volt DC power for the modified LNA. The waveguide input flange is WR-75 and will fit up to WR-90 waveguide switches by drilling out the four mounting holes through the back of the flange mount on the LNA and cutting away the outside edge to allow a screw to fit the pattern of the WR-90 flange. The 4 bolts will hold the mismatched waveguide fittings together with little trouble. It has been shown that as little as two screws will hold the LNA to a WR-90 waveguide fitting with great rigidity.

Here is a full side view of the Channel Master LNB (**Photo** C) depicting the DRO removed along with a second top cover plate and DRO mounting plate and coax "F" connector. The "F" connector is removed and replaced with a feedthrough capacitor to bring DC only to the connection previously soldered to the "F" connector; mounting of the feedthrough cap is not critical. The DRO oscillator was removed in this picture, but where the top left pin of the DRO module is soldered to on the top LNA part of the PC board, it is replaced with the center pin of the SMA connector.

Fig. 1 is a short version of a reverse-engineered schematic of the beige downconverter. As you can see from the schematic, the DRO module we described was of great interest. It was discovered that not only was there an internal microwave DRO-type oscillator, but the RF mixer and IF preamplifier at 1 to 2 GHz range were also co-located inside this module as well. Quite high-tech to say the least. This fact made the conversion easy, as the remaining circuitry was the power supply and microwave RF circuits. These were the ideal remaining components, as the DRO, mixer, and IF were not needed in trying to make a great 10 GHz LNA for amateur microwave use. By the way, no conversion for frequency operation at the lower 10 GHz seemed to be needed — just the removal of the output filter and replacing it with a 1 to 2 pF microwave chip capacitor was required.

This mod was the result of several amateurs pooling efforts and making this project work. Ed W6OYJ, Pete W6DXJ, Kerry N6IZW, and I are all members of the San Diego Microwave Group. Recently, a quantity of these LNB amplifiers, along with several other types of slightly different

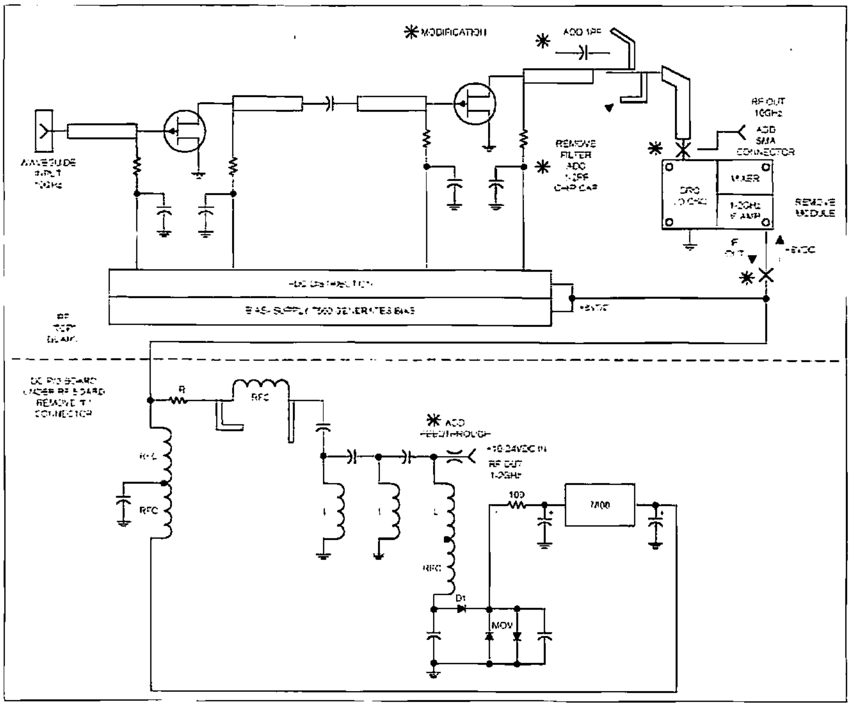

Fig. 1. A short version of a reverse-engineered schematic of the beige downconverter.

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QRP-pourri

I had planned to have some receiver troubleshooting tips this month. But instead we will look at another project. I got started in getting the project done when working a keyer for Field Day. After a few months of Heathkit QRP radios, why not wrap things up with a look at the Heathkit HD-1410 keyer?

Of all the products Heathkit made, it seems kind of strange that they only made three versions of a CW keyer. The first was the rather funky HD-10 keyer. It had microswitches for the paddle contacts. It did not have a "fine" feel to the key. It did work, and Heath sold zillions of them. The HD-10 was designed primarily for the SB and HW tube-based gear that used grid-blocked keying.

The next keyer, the HD-1410, is a ripped off version of the Ten-Tec KR5 keyer. The electronics and key paddle are mounted in a slimline case.

The Heathkit HD-1410 iambic keyer is a very popular unit. Many of these are still in use today. Although the keying paddles are not by any means a Brown Brothers' key paddle, they're not too bad!

The HD-1410 features a built-in power supply and adjustable sidetone. The sidetone pitch is also adjustable, although you must open the case to access this control. The HD-1410 will operate on either 12 VDC or 110 VAC. What's nice about the 110 AC supply is the detectable power cord. If you want to use the HD-1410 during Field Day, you don't need to bring along the AC power cord.

The output is fully solid state. The HD-1410 will key either grid-block- or cathode-keyed transmitters. There's a jack for a straight key, too, although I don't know why you would use one with the keyer.

By pulling out the speed control, the HD-1410 will key the transmitter. That's a great feature for tuning the antenna tuner. There is a second knob on the front panel that controls the volume of the sidetone. And, like I said, a PC board–mounted trimmer controls sidetone pitch.

All of this is housed in a small wrap-around case that matches the "SB" line of Heathkit equipment — in particular, the SB-104 and the HX-1681 transmitter, HR-1680 receiver. Heath did not change the color of the keyer to match the HW-9 or HW-99 transceivers. The HD-1410 continued with the Heathkit two-tone green paint job.

Since the HD-1410 is fully solid state, a good place to start looking for trouble is the power supply. If the HD-1410 works on an external battery but not on AC, check the 110 AC fuse and the power transformer. On the other hand, if the keyer seems dead, but the red power lamp comes on, check Q8 and D7. With a DVM, check the voltage on the collector of Q8. It should be at least 10 volts. The output, on the emitter should be at least 5 volts. If the emitter is over five volts, then Q8 is shorted. If the output on the emitter is zero, then suspect Q8 or D7. Diode D7 biases the driver transistor on. The TTL IC chips in the HD-1410 require +5 volts to operate. Too much or too low of voltage will cause the HD-1410 to fail.

A common problem is a shorted or open output transistor. You can easily check this by turning up the sidetone volume. If the sidetone follows the keying, then the keyer is working, but the output keying transistors have failed. Check Q5, Q6 and Q7. Also, check diodes D4 and D5. These parts fail if you try to key a transmitter the HD-1410 cannot handle.

I did mention that the HD-1410 would key a cathode-keyed radio. That's true, but you can't key an Elmac AF-67 with one. There are limits on the keying current the output keying transistors can handle.

To get the HD-1410 to key most solid state transmitters, remove D5 and R27 and replace these with jumper wires. This will allow the HD-1410 to pull the keying line to ground. You'll need to do this modification if you want to use the HD-1410 with your Ten-Tec Argonaut transceiver.

I've found that IC3 can go bad and cause a string of either dots or dashes to be produced. Also check IC 5.

IC5 also drives the sidetone oscillator. Transistor Q3 takes the output from IC5 and drives the speaker.

After years of use, the paddles may need to be removed and cleaned. To remove the paddles, pull off the black plastic covers. Then, remove the speed and sidetone volume controls. Unsolder the wires from the pilot light. You can then pull down the front panel. There are a few screws holding the paddle assembly on the PC board. After removing the hardware, the paddles can be removed. Clean the contacts with a strip of typing paper. You can clean the contacts without taking the paddles apart or removing them from the case.

The Heathkit SA-5010 keyer

This keyer is a drastic departure from the HD-1410 keyer. The SA-5010 is a microprocessor-based electronic keyer. The SA-5010 will key either grid-block or pull the key line to ground. Again, there's a limit to how much current the output transistor will handle.

Housed in a two-piece plastic clamshell case that's really hard to reassemble, the SA-5010 came in two different paint jobs. You could get one to match the SB-104 line or one to match the HW-9.

The microprocessor was custom-made for Heath. Finding a replacement would be next to impossible. So, if the micro is cooked, *you're* cooked. However, I've never come across one with a bad CPU. Most of the time, the output switching transistors

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Hams Make Good Use of High-Tech

This month, I want to touch on several areas that prove interesting on discovery. First, there are several new wrinkles in the MixW software. Those of you who are using the program and keeping up with the releases will think this is dated material because of the warp-speed development combined with the time lag due to publication schedule.

But for the rest of you, the following is going to sound much like way far-out tech. And that is exactly how it impressed me as I came across these developments.

New stuff in MixW 2

If you have looked around a bit, you have discovered software to roll-your-own QSL cards. I have a few of those very fine programs on the back burner of this computer and simply never devoted enough (any) time to them so I could send out modern cards that do not include the option of AM mode along with a few other thoughts from antiquity.

So, what would you think if you could simply select a QSO from your log, double-click a utility, and have a card ready to print? That is available in the Release 10 of MixW 2 that I am currently using. Absolutely amazed me.

I knew there was something of this nature available according to a few posts on the MixW reflector. I printed out the several pages of newsy items from the MixW download page and read the info on the card utility a few times. It was only about two short paragraphs and, for some reason, the brevity intimidated me. It just couldn't be this easy — had to be a catch.

KB7NO

Jack in Carson City, NV

To radio: W9LR Bill New Berlin, WI

Date	UTC	Band	Mode	RST
15-Aug-2001	03:15	14.1 MHz	BPSK31	599

Thanks for the nice QSO! 73! I use MixW version 2.0 RC10.

Fig. 1. Just a couple of clicks! This is s-o-o-o easy. Select the QSO from the MixW 2 log, double-click the file (see text) in the MixW folder and this prints on your Microsoft Word page. And it looks better than this if you simply print it to some card stock and mail it off. For some reason, the resolution went down the tube when I ran this into the clipboard and massaged it in the graphics program. But it does serve the purpose: you get a custom QSL print you will not be ashamed of and IT IS FREE. Always counts in my (pocket) book. If you are using the latest version of Word, the instructions say you can do a bit of customizing. The above print is as it comes from the box. This was the first experiment. Simply closed my eyes and shot from the hip.

But I took a deep breath and followed the simple directions which started with double-clicking the MixW QSL card test.doc which resides in the MixW folder. Being a .doc file means it will open in Microsoft Word. Not bad. I use the earliest version of Word for Windows which is Word 6 and was originally written for Windows 3.1, so this is a good test.

It works. The test document is a card already made up for UU9JDR as an example. Things didn't work at first because it is necessary to have MixW 2 up and running, but that is easy. The sample card is quite like the one in the screenshot this month, with different input, and is very easily duplicated with your own callsign and info.

The part that makes this so overwhelmingly simple is the process is just two steps. With MixW 2 and Word up and running, you first select the log entry for which you want the card primed. Second, using Explorer, go to your folder where MixW resides and double click the file MixW QSL card test.doc. That's it, nothing more. Your custom card assembles itself in the Word display.

Next, I printed a couple of cards for recent contacts and sent them out via E-mail as attached files. During the process, I realized there is a percentage of hams who will not be able to open these files because they will not have the correct software. I think most of the later WordPerfect software will open such files but I hate to send stuff that looks suspicious on the receiver's end.

The real point is it will be a simple project to print some of these and send them through the old fashioned mail system. As a matter of fact, by the time you read this, I would not be surprised if some of you have not already received a card like this from someone else. It looks like something that could really catch on.

Just as a further experiment, I did a lookup for a QSO in the MixW log that was earlier history and the card print system worked just fine from the info in the lookup result window. That makes certain situations easier to manage.

For instance, at this time MixW 2 does not allow a scroll feature in the log so you could select an entry directly for this card print process. I have seen a rumor that that feature may surface from the pile of things-to-do sometime soon. But that is not a hindrance to making these cards.

As I looked further into the minimal documentation I found field editing available if I were using the latest version of Word for Windows. This does not seem to be an absolute necessity, but perhaps the bundled software with the new computer has something in Microsoft Works that will lend a hand for a little tweaking.

How about an atlas?

Another feature that works extremely easily is the interface to the DxAtlas software which can be downloaded from [www.dxatlas.com]. If you go to the MixW Web site, you can download the file [Mix2DxAtlas1.zip]. With those two files you will be surprised how easily you can display a world map that gives you beam headings along with sunrise-sunset indicator and other useful information for your DX hunting.

Simply install the software per the instructions, then when you are running MixW2 and DxAtlas along with the Mix2DxAtlas utility, you simply double-click the callsign in the receive field as you make ready to make the contact and the DxAtlas program will display the location of the other station and when you point your cursor to the location the beam heading is calculated for you. Can't get any easier, plus, it is fun to do.

I shouldn't admit how some of these big-kid toys fascinate me. I can sit and see the calls on the monitor and, instead of trying to work them, I will start clicking on them so I can watch the programs strut their stuff. To be fair, I should mention DxAtlas is shareware and the demo copy is good for 30 days.

This kind of automation is making me entirely too lazy (and very addicted) for my own good. Here I have assembled a group of software on a simple old slow computer that works most every popular digital mode in use by active hams. Plus, it accesses my CD with ham addresses automatically, pops up previous contacts and now it simultaneously shows me where the other station is and how to head the antenna.

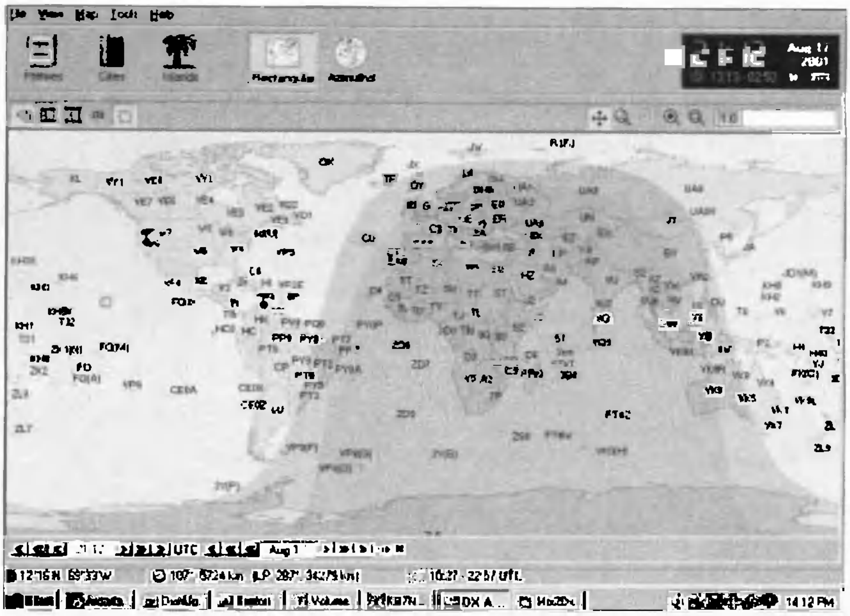

Fig. 2. DxAtlas in action. This is the flat world view of the world atlas. Also available is an azimuthal layout with your station located in the middle and the rest of the world revolving around you. Your choice — you can change it instantly back and forth. The overall size of the panel can be reduced to fit along side your MixW display or you can have them overlap. This view is shown over top and completely covering the MixW 2 display. If you do it this way, you can switch back and forth with the task bar buttons at the bottom. The KB7NO location is indicated by the antenna planted to the left of the W7 in the western U.S. When I double-clicked the PJ2 station in the receive pane in MixW, an antenna showed in the very northern part of South America. By moving the cursor to that point and clicking the mouse the program calculated beam headings and distances in the info box above the task bar. This was taken about 2 p.m. local time and you can spot the location of the sun by the bright (yellow) spot about 1,500 miles SW of the home QTH. You can see the sunrise-sunset indicator covering Europe, Africa, and most of Asia. There are several options for lookup on prefixes, countries, cities, etc., I did not wish to confuse the display with clutter. DxAtlas integrates nicely with MixW 2 with the patch shown by the button at the right of the task bar (Mix2Dx) that can be downloaded free. See text.

Then when I get all through with the contact, all that is necessary to produce a QSL card are a few simple clicks. A few more automated procedures and the station will be illegal; there won't be any need for a human at the controls. It will wake itself up in the middle of the night and start making contacts. Too much . . .

There is more. I haven't mentioned the automatic lookups you can effect with MixW via Internet databases. Mostly I have not mentioned this because I cannot demonstrate this on this limited old computer.

And there are another couple of items to make ham life more fun and less threatening that have to do with automatic antenna selection and heading. These are also covered in the material on the MixW Web site. And, due to lack of equipment in that category, I have not covered these subjects for you.

Upgrading the shack — again

But there is an area that I am trying to come up to speed. I think my wife was beginning to think I was about to break her new computer as I was having to rely more and more on it to test some of the new and improved software that keeps coming down the pike. So she caught me in a moment of weakness and insisted it was time to get a new computer.

I have it sitting on the floor just outside the door to the shack at this time. As soon as I get this article off in the mail that will be the next major shack project. I tried to get enough bells and whistles to be able to do all that might be deemed necessary for hookups and speed. More on that as I progress.

I did manage to purchase the largest monitor I could afford. It is still one size

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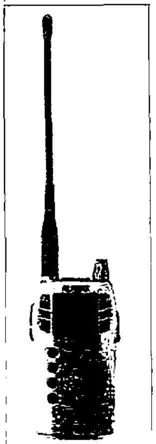
New Products



Alinco Introduces DJ-X3 Scanning Receiver— Compact Design Features "Hidden" Speaker

Alinco is announcing the release and FCC Type-acceptance of its new DJ-X3 scanning receiver, a compact unit that can receive from 100 kHz to 1.3 GHz in AM and wide or narrow FM modes. Announcement of the new unit was made by Craig Cota of ATOC Amateur Distributing, which distributes Alinco products to dealers in the USA and Canada.

• The DJ-X3 has a very distinctive design that places the speaker behind the display. Audio is heard from ports on either side of the display window. The compact unit easily fits in a shirt or jacket pocket. The DJ-X3 features 700 memory channels (10 banks of 70 channels), is powered by a rechargeable Ni-MH battery and also comes with a dry cell (3 X AA) battery pack. The triple conversion IF stage provides excellent reception.

• The DJ-X3 can reproduce FM stereo when optional stereo headphones are connected to the unit. The operator also has four selectable antenna choices: an internal AM bar antenna, a shortwave bar antenna, the earphone cable may be used as an antenna, or the SMA whip antenna terminal can be activated. The unit is supplied with a removable whip antenna but an external antenna can also be connected to the SMA port. An attenuator function is available to reduce very strong signals. The receiver also has a "bug" detector, useful in searching for hidden transmitters.

• The DJ-X3 has three operating profiles, VFO, Preset AM, FM and TV frequencies and the Memory mode. The operator can make manual selections or scan in any of those modes. In the memory scan mode, the operator can choose one specified bank, certain banks can be linked for scanning or one can choose to scan all banks. There are 20 program and memory scan options.

• The DJ-X3 is capable of tuning in user-defined steps of 5, 6.25, 8.33, 10, 12.5, 15, 20, 25, 30, 50 and 100 kHz. The unit also has an AUTO step mode that selects the appropriate step for the band currently in use.

• The illuminated display is large and easy to read. In addition to frequency information, it will also show the operating mode, memory channel, battery strength, signal strength, and a number of other user-selected operating parameters. A charger, belt clip and strap are also included. The DJ-X3 can also "clone" to other DJ-X3 units, sharing its programmed parameters through a wire connection.

"The DJ-X3 is an exciting new addition to our growing line of receivers," said Mr. Cota. "It is a great performer in a compact package. Along with the DJ-X2000, DJ-X2, and the DJ-X10, Alinco now offers the monitoring enthusiast a wide range of choices in receivers in different price ranges."

The DJ-X3 is expected to be available in stores soon. MSRP is $302.95. Accessories for the unit, such as extra battery packs, are also available. Dealers are free to set their own prices and often sell at prices below the MSRP.

Disclaimer: Specifications subject to change without notice or obligation.

For more information, contact Evelyn Garrison WS7A at (425) 557-9611.

Special Christmas Key

In celebration of the season, Morse Express has commissioned a special telegraph key which will double nicely as a Christmas tree ornament.

The Morse Express Christmas key is a fully operational miniature key, hand-machined from solid brass and plated in gold. It measures a tiny 1-3/4 in. by 15/16 in. at the base and weighs a mere 2 oz.

Designed by Marshall Emm N1FN, the Chrisunas key was a challenge for European key maker Llaves Telegraphicas Artisanas. All the usual adjustments (trunnion bearing tension, lever spring tension, and contact spacing) are available by means of gold-plated screws and matching lock nuts, and the indented knob is very comfortable in use. All of the machining and assembly processes were done by hand.

The result, according to Emm, is "a pretty little key that will make an excellent Christmas tree decoration or stocking stuffer, but is also eminently usable for sending code. It's the smallest key we sell, and one of the smallest we've ever seen, so it will be very handy for QRP portable operations. It will also add something special to Straight Key Night."

The base of each key is engraved with the Morse Express logo and "Christmas 2001." This is a limited edition of 200 keys, and each bears an engraved serial number on the base.

The Morse Express Christmas Key is $49.95, plus s/h, and is available only from Morse Express. Photos and more information are available on the Morse Express Web site at [www.MorseX.com], where you will also find secure ordering facilities. Call (800) 238-8205 toll-free to order by phone, or (303) 752-3382 for more information.

PkTerm '99 Version 1.5 Now Out

Creative Services Software has now released version 1.5 of PkTerm '99, which supports the hot new digital mode PSK-31 as well as the AGW Packet Engine.

All of the features of PkTerm 1.5 except for one are available as a free update if you don't have the PK-232/PSK-31 hardware interface, or if you purchased PkTerm '99 after May 15, 2001. If you do own the interface, and purchased PkTerm '99 before May 15, then the update is $29.95 for everything.

For further information, contact Creative Services Software, 503 West State St., Suite 4, Muscle Shoals AL 35661; (256) 381-6100; [www.cssincorp.com].

The Digital Port

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down from the one that would have required a crow bar to get it through the door to the shack. There was a $500 difference to go from 19 to 22 inches, so I only have to move one of the shelves to get it in here. Speaking of large, I doubt if the box the 19-inch monitor came in would have made it through the door without a squeeze.

By measurement, the available surface area on the 19-inch monitor is approximately 75 to 80 percent greater than the 15-inch. I think that will suffice to arrange the pictures for ease of viewing. Will let you know.

Just a little side note. Just a day or so after the purchase of the new machine, the XYL and I were passing a counter display in an office supply and I spotted one of those real treasures. Actually, the display was covered with glass to keep strangers with grubby little paws from touching.

Inside the glass display case were a few honest-to-goodness fountain pens. We managed to get permission for me to hold one in my hand. They have changed the design a bit over the years. There is no exposed lever to aid in filling. The inside seemed empty and I asked where the bladder was.

Trying to either suppress a smirk or not let on she did not know what I meant, the girl behind the counter went and retrieved the innards of the mechanism from the back room and showed me a plastic cylinder with a twist mechanism on the end. Twist the knob with the pen immersed in the ink bottle and it draws ink into the cylinder.

The point of all this is that after the XYL became certain this was the find of the day and I should have one, she mentioned the fact that with such a fine writing instrument as this I might not really need that new computer after all. I told her the computer was still necessary, but the pen would become nearly indispensable if the printer failed. Plus, the pen has a lifetime warranty — the life of the owner, not the pen. Try to match that with the computer or the printer.

Source for:	Web address (URL):
Mix W Soundcard program for PSK31, RTTY, new modes, MTTY, FSK31, more	http://tav.kiev.ua/~nick/mixw2/ www.nvbb.net/~jaffejim/mixwpage.htm
FREE MMHam site — MMTTY — MMSSTV	www.geocities.com/mmhamsoft/
FREE VK7AAB — SSTV-PAL — PSK-PAL	http://users.origin.net.au/~crac/
Much ham info w/SSTV downloads	www.conknet.com/~kb1hj/index.htm
TrueTTY — Sound card RTTY w/ PSK31	www.dxsoft.com/mitrtty.htm
Pasokon SSTV programs & hardware	www.ultranet.com/~sstv/lite.html
PSK31 — Free — and much PSK info	http://aintel.bi.ehu.es/psk31.html
Interface for digital - rigs to computers	www.westmountainradio.com/RIGblaster.htm
Soundcard interface info — includes Alinco	www.packetradio.com/psk31.htm
Interface info for DIY digital hams	www.qsl.net/wm2u/interface.html
WinWarbler info and DXLab Suite	www.qsl.net/winwarbler/
MFSK-related tech info — how it works	www.qsl.net/zl1bpu/
Throb — New — lots of info	www.lsear.freeserve.co.uk/ www.btinternet.com/~g3vfp/
Download Logger, also Zakanaka	http://www.qsl.net/kc4elo/
PSKGNR — Front end for PSK31	www.al-williams.com/wd5gnr/pskgnr.htm
DigiPan — PSK31 — easy to use	http://members.home.com/hteller/digipan/
TAPR — Lots of info	www.tapr.org
TNC to radio wiring help	http://freeweb.pdq.net/medcalf/ztx/
ChromaPIX and ChromaSound DSP software	www.siliconpixels.com
Creative Services S/W Multimode w/PSK	http://www.cssincorp.com/products.htm
Timewave DSP & AEA (prev.) products	www.timewave.com
Auto tuner and other kits	www.ldgelectronics.com
XPWare — TNC software with sample DL	www.goodnet.com/~gjohnson/
RCKRtty Windows program with free DL	http://www.rckrtty.de/
HF serial modem plans & RTTY & Pactor	http://home.att.net/~k7szi/
SV2AGW free Win95 programs	www.raag.org/index1.htm
Source for BayPac BP-2M & APRS	www.tigenronics.com/
Int'l Visual Communications Assn. — nonprofit org. dedicated to SSTV	www.mindspring.com/~sstv/
Hellschreiber & MT63 & MFSK16 (Stream)	http://iz8bly.sysonline.it
HamScope — multimode w/ MFSK16	http://users.mesatop.com/~ghansen/
YPLog shareware log — rig control — free demo	www.nucleus.com/~field/
WinLink 2000 System info	www.winlink.org/k4cjx/
Airmail — free program to use WinLink 2000	www.arimail2000.com/

Table 1. The Infamous Chart ... updated monthly.

More on DxLabs

Last month's article is quickly becoming outdated as the work continues on the DxLabs projects. I did a bit of a no-no as I sent that article off. The time had gotten in very short supply due to technical difficulties with the previous Internet connection and getting the new setup going. Not very good excuses, but I notified Dave AA6YQ, after the mailing and included the text of the article he was not aware I was writing.

Needless to say, this resulted in an unintended surprise to the author of the fine software I wrote about. Dave was gracious and offered a few corrections and since that time I discovered he is involved in another great all-encompassing software project.

He is not only heading toward more modes than what the current PSK31 WinWarbler software offers, but is also about to embark on a project to expand past the Icom line of rig control. By the time this reaches print, you may be able to find support for the Yaesu rigs on the WinWarbler Web site and I can only guess how much more.

There are a lot of projects being initiated by the fertile minds of some of our leading ham oriented software folks. I really like what Dave has done and is doing. It would seem that doing all this work without asking for any pay in return should cause the

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Updates

If you missed last month's issue of 73, find a copy! The issue was packed with feature articles about the amateur-radio satellites. All of the authors involved are experts on many facets of space communications. The November 2001 issue will be a useful tool for satellite enthusiasts, and not just a one-month curiosity. Check it out!

New hamsats in orbit: On September 30th, four satellites were launched from the Kodiak Island launch complex in Alaska on a single Lockheed-Martin Athena-I rocket. The satellites included PCsat, SAPPHIRE, Starshine 3, and PicoSat. Three of the four satellites were designed to use VHF and UHF amateur-radio frequencies. The orbits are polar LEO (Low Earth Orbit) from 500 to 800 km.

PCsat

PCsat is the result of a U.S. Naval Academy project for students pursuing an aerospace major. The goal was to provide students with a hands-on experience in satellite design and operations. Funding was provided by the U.S. Naval Academy, and a grant from the Boeing Corporation. The launch was secured through the Department of Defense Space Test Program in cooperation with NASA. Even before the successful launch, the project had achieved its goal of designing and building a viable spacecraft. Bob Bruninga WB4APR provided an excellent article about the program and its operation in the November *73*.

The mission of PCsat is to provide mobile and handheld digital communications for amateur-radio satellite operators using APRS (Automatic Position Reporting System). APRS has become more than just another use for packet radio. For many hams, packet has simply been a means to get on APRS. Those who have used APRS know that it is a lot more than a solution looking for a problem. It has become an easy and entertaining way to track the locations of friends, balloons, boats, planes, and just about anything that can carry a transceiver, TNC (Terminal Node Controller), and GPS (Global Positioning System) receiver. Now we have a satellite to relay this data to and from remote locations, not to mention the short-message feature that allows users to send and receive brief communications along with latitude and longitude location data. Although Bob WB4APR had originally anticipated a two-week checkout after launch before the satellite would be released for general use, it only took a few days to test all systems and declare PCsat ready to go. For detailed and current satellite information see [http://web.usna. navy.mil/~bruninga/pcsat.html].

SAPPHIRE

SAPPHIRE is the first Satellite QUIck Research Testbed (SQUIRT) satellite and the second to fly. OPAL was the second satellite of the SQUIRT series, but the first to fly. The name SAPPHIRE stands for Stanford Audio- Phonic Photographic InfraRed Experiment. The SAPPHIRE project was started in 1994 and was ready for launch in 1998. But now, three years later, SAPPHIRE is finally in orbit. The satellite was developed by the Stanford Space Systems Development Laboratory to allow graduate students to gain experience in satellite design and construction.

SAPPHIRE carries three main experiments. The primary payload is a group of Tunneling Horizon Detectors. They are a new generation of infrared sensors that have been micromachined to fit in a chip and operate at room temperature. The digital camera experiment uses a Logitech digital camera called the Fotoman Plus. It can take and store 32 pictures in JPG format for transmission to ground stations. The third experiment is called Digitalker. It simply converts a text string to voice output for transmission via the 70cm FM transmitter. More information about SAPPHIRE can be found on the Internet at [http://students.cec.wustl.edu/~sapphire/sysoverview.html].

Starshine 3

Project Starshine is a program developed by Gil Moore of Monument, Colorado, to encourage and involve younger students in satellites. Each Starshine satellite is covered with small round mirrors like a disco ball. Mirror kits are sent to school groups that wish to participate. The mirrors need to be ground, polished and returned for installation on the satellite. After launch the students learn about satellite orbits, and on appropriate passes, get a chance to see sunlight reflect from the satellite's mirrored surface. Starshine 3 is the third spacecraft in the series, but the second to achieve orbit. Starshine 2 is ready and waiting for launch on STS-108 later this year.

Starshine 3 is a 37-inch-diameter hollow

Satellite	Downlink	Uplink	
PCsat	145.825	435.250	1200 or 9600 baud AX.25 FM mobile
	145.825	145.825	1200 baud AX.25 APRS FM HT
	144.390		1200 baud AX.25 APRS special broadcast
SAPPHIRE	437.100	145.945	1200 baud AX.25 FM*
Starshine 3	145.825		9600 baud AX.25 FM data

*SAPPHIRE is also capable of synthesized voice downlink.

Table 1. New hamsat frequencies (MHz).

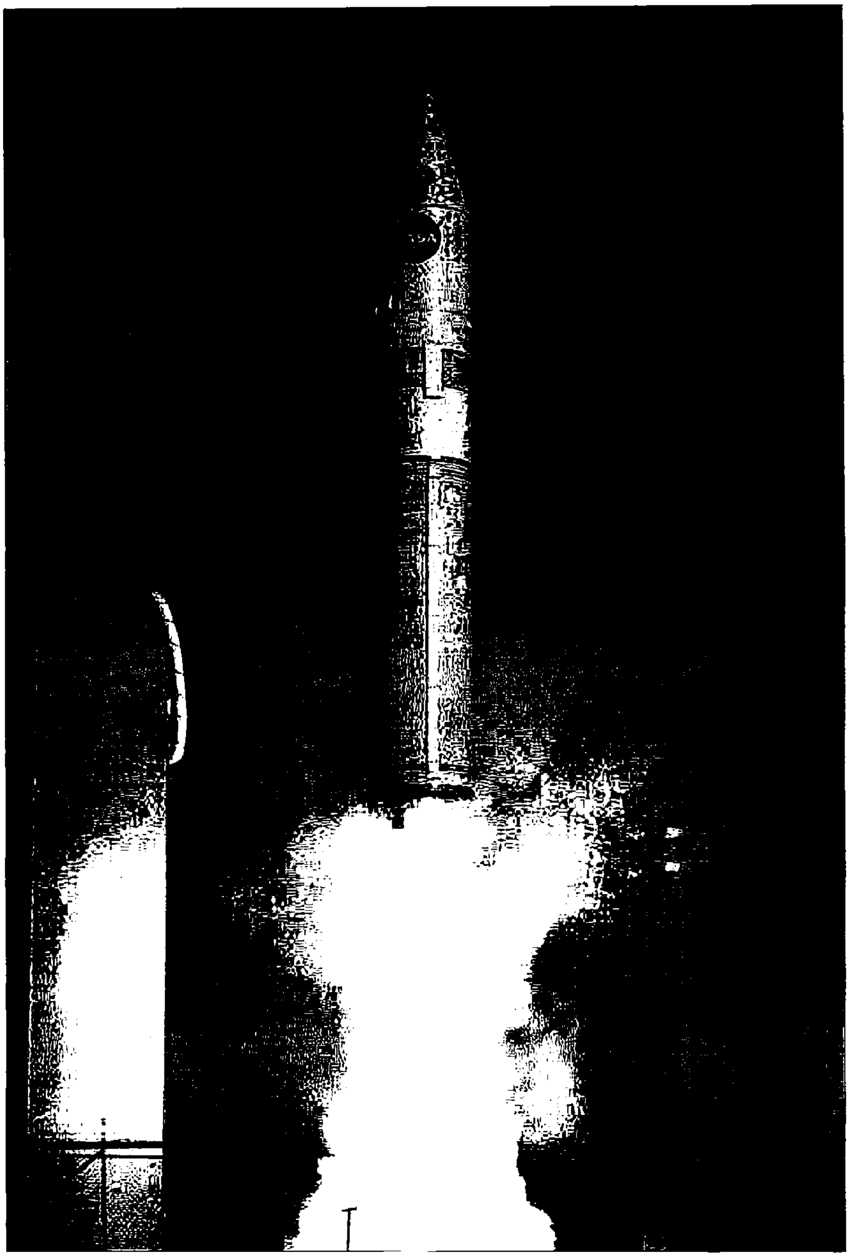

Photo A. PCsat, SAPPHIRE, and Starshine-3 all were on board the first orbital launch from Kodiak Island, Alaska. (NASA Photo)

aluminum sphere covered with 1,500 mirrors, 31 laser retroreflectors, and seven solar-cell clusters. There is also a 9600-baud packet telemetry system on 145.825 MHz to send back data about the system's power status and the satellite's spin rate. Data bursts are typically sent once or twice a minute via a 1.25-watt FM transmitter to a pair of quarter-wave monopole antennas. Later Starshine satellites will incorporate spin-up and spin-down systems. Hams are encouraged to collect telemetry from Starshine 3 and forward it via a radio data collection Web site [http://www.epulation. com/starshine]. The main mailing address is Project Starshine, 3855 Sierra Vista Road, Monument CO 80132. More information about the past, current and future programs can be found at [http://www.azinet.com/starshine/].

PicoSat

The final passenger on the flight was PicoSat. This small satellite was built by the same group that has provided so many UoSATs over the years, Surrey Satellite Technology, Ltd., at the University of Surrey in Guildford, England. The satellite was built under contract with the U.S. Air Force to test four experiments, including an RF beacon, GPS Ionospheric Sounding Payload, a Polymer Battery, and an Ultra-Quiet Stabilization Platform. There are no amateur-radio-frequency transmitters on board. Check [http://www.sstl.co.uk] for more on projects from the folks who brought you the highly popular UoSATs.

Athena

All of these satellites went to orbit on a Lockheed-Martin Athena-I booster from the commercial Kodiak launch complex on Kodiak Island off the south coast of Alaska. This was the third launch from the Alaska Aerospace Development Corporation's new 27-acre complex, but the first for an orbital mission dubbed Kodiak Star. The Athena-I is a three-stage rocket specifically designed for sending payloads that weigh 3,300 pounds (1,500 kg) or more to low orbits. The launcher for this flight was originally slated to carry the Vegetation Canopy Lidar satellite, but due to schedule slips, and the fact that the satellite has grown too large for an Athena-I, our hamsats and PicoSat got a ride.

The flight was broadcast via NASA-Select TV. During the wait for launch and various countdown holds, viewers got to see some of the beautiful sights on Kodiak Island, including wild horses milling around one of the tracking antennas, buffalo grazing nearby, flocks of birds, and even whales off the coast. The NASA broadcast also carried footage of the integration of the satellites and the launcher preparations. For details about the Kodiak Launch Complex, go to [http://www.akaerospace.com].

W3ADO-11>BEACON,SGATE:T#712,162,163,052,213,213,11111111,0011,1
KB7ADO-8>BEACON,W3ADO-1*:SYSTOP TEST NO users please. Wait till users authorized.
W3ADO-1>APRS3:Default LT3
W3ADO-1>BEACON,SGATE:T#713,159,066,139,044,213,11111110,0000,1
W3ADO-1>BEACON,SGATE:T#715,108,102,067,232,213,11111111,0010,1
W3ADO-1>APRS2:Default LT2
W3ADO-1>BEACON,SGATE:T#719,110,103,089,158,213,11111111,0010,1
W3ADO-1>BEACON,SGATE:US Naval Academy Prototype Comm. Sat. PCsat(A)

Table 2. A small sample of packet data received from PCsat on its first day in orbit.

ON THE GO

Mobile, Portable and Emergency Operation

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How Do *You* Communicate?

Ham radio operators often think of themselves as great communicators, and in some ways we are excellent. In other ways, such as when talking to nonhams about the hobby, we may have difficulty in getting our message across.

There's a famous comedy sketch in which a character announces that he's a ham radio operator with "friends all over the world — all over the world. (pause) But none around here." We all laugh at the joke, because there is an element of truth to it. Some of us do better when in contact with another ham thousands of miles away than when talking with some people only a few feet away. Of course, it could be argued that the majority of our contacts are not really communication in the true sense of the word. If your average QSO consists of two callsigns and "five-nine," it cannot be compared to a true conversation. However, I believe that most of us are rag-chewers at heart and enjoy the communications aspect of the hobby as much as the technical side. One of the most important contacts we can ever make is with someone who might have an interest in the hobby. Unfortunately, while some hams are very skilled at this, some of us could use a little coaching.

We need to have a steady stream of new hams in the hobby or else we can bid a fond farewell to the hobby itself. Without a significant presence, we hams are going to lose our most important resource — our frequencies. The reality is such that being elite does not justify access to a rare commodity that is in high demand. A small number of hams who are highly skilled, technically expert, and dedicated to the hobby do not carry the clout of a large number of hams of whatever caliber. Whether we like it or not, that is a fact. Therefore, it is in our very own selfish best interests to sincerely invite in as many potential hams as we can.

There are a lot of people who could be interested in the hobby, if we effectively communicated its benefits. The problem is that many people don't know it even exists. Some are not aware of the hobby at all, while others think that this went out with Morse Code and the big bands. Ham radio is one of the best-kept secrets around. We need to let people know ham radio exists and that they just might enjoy themselves.

Kids are naturals for ham radio today, just like when I was a kid. The difference is that they have a lot more options, and like most logical people are going to seek the path that provides the most benefit with the least investment. It's not a "dumbing down" as much as common sense. Why should anyone work twice as hard for the same outcome? If my goal is to talk to people all over the world, I can do that by ham radio or by the Internet. If I want to talk to friends at the other end of the amusement park, I can use a two-meter HT, a cell phone, or a Family Radio Service radio. Which is easier?

Rule Number One: Focus on the benefits of the hobby. With my interest in emergency communications, I find it important that in a pinch, ham radio is the best chance to maintain communications. No other option exists in some situations. Other people have different benefits to focus on. Interested in space? Ham radio can communicate with the International Space Station and has its own satellites. Enjoy model rocketry or radio-controlled aircraft? Ham radio can be your telemetry or video downlink as well as your control frequency.

Rule Number Two: When speaking to someone about ham radio, don't try to impress them with your trials and tribulations. How many people do we scare off with our dissertation about the difficulty of the license exam? Do you truly believe that most folks who have a potential interest in the hobby wouldn't be able to pass the exam

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Photo A. Kids today can be as attracted to ham radio as we were, but we have to compete with the Internet and other technology to catch their attention.

Homing In

Radio Direction Finding

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ARDF Championships, Part 1: Triumph in the Land of Enchantment

Just over a year ago, "Homing In" announced the search for a local radio club to host the first-ever national on-foot radio direction finding (RDF) championships in the USA. Ink on the last copy of the press run was barely dry when Albuquerque Amateur Radio Club (AARC) answered the call. Its members were eager to put on this historic event.

License plates in New Mexico proudly proclaim that it's the Land of Enchantment. From July 31 to August 4, it was the land of international-rules competitive RDF, also called foxhunting, foxtailing, radio-orienteering, and ARDF. Anyone, with or without a ham license, was welcome to enter the First USA ARDF Championships by paying the registration fee and traveling to Albuquerque.

Perhaps AARC's leaders didn't fully understand what they were signing up for, but they were definitely up to the task. Following the suggestions in my site-search article,[1] they arranged for housing, local transportation, hunt venues, maps, medals, and the endless other details of a well-run radiosports event. I have much more to say about the fine people that made it a rousing success, but first let's focus on the competitors and how they fared.

A cross-section of America

We sought entrants from every part of the country and with every ARDF skill level, from beginner to expert. In the end, ten states from coast to coast and border to border were represented. Although there was no formal teaming among the stateside hunters, some of them had trained together and put on local practice sessions for each other.

California sent the greatest number. The most experienced was Marvin Johnston KE6HTS from Santa Barbara. He had been on Team USA for the ARDF World Championships (WCs) in 1998 in Hungary[2] and

Photo A. *Scott Moore KF6IKO of Santa Barbara is not having a good day on the 2m hunt, but he will go on to win a silver medal on 80m.*

Photo B. *Sixteen-year-old Jay Thompson W6JAY accepts gold medals for both 80m and 2m from AARC president Mike Eaton K5MJE.*

Photo C. Wearing his skirted "Flying Nun" hat, Steve Shannonhouse from Georgia follows a wash toward the finish corridor.

Valley Radio Club near Los Angeles. Although this was their first out-of-state event, they were experienced foxhunters, having already won trophies at on-foot hunts of ARRL Southwestern Division conventions and the West Coast VHF/UHF Conference.

The next-largest regional group came from the Peachtree State, where the Georgia Orienteering Club (GAOC) has been including radio-orienteering in its activities for a

Photo D. Dick Arnett WB4SUV of Erlanger KY catches his breath after a gold medal–winning run. After losing his glasses on the championship course in China last year, he got a band to keep them firmly on his head this time.

2000 in China.[3] A strong promoter of ARDF in his home town, KE6HTS encouraged two local newcomers, Scott Moore KF6IKO (**Photo A**) and Dave Jacobs K9KBX, to make the trip, and he helped them with training. Two other veterans of the China WCs were Jay Thompson W6JAY (**Photo B**) and his father Richard WA6NOL, who arrived by train from Santa Ana, California. Jay, who turned 16 just before the Albuquerque events, was this year's youngest competitor.

Scot Barth KA6UDZ and Rick Barrett KE6DKF are members of the San Gabriel

Photo E. As photographers and timers stand at the ready, Byon Garrabrant N6BG of Las Vegas NV heads up the corridor to the 2m finish line.

couple of years under the leadership of Sam Smith N4MAP. Other GAOC members in Albuquerque were Kevin Haywood N4MGB, Steve Shannonhouse (**Photo C**), and Bill Farrell.

Traveling south from the Denver area were Larry Benko WØQE, Dave D'Epagnier KØQE, and Larry Noble NØNDM. Despite being newcomers, all were quick learners and good athletes. From the Cincinnati area came Dick Arnett WB4SUV (**Photo D**) and Bob Frey WA6EZV. Both had been to the China WCs and had trained hard for success in 2001.

Four localities with active ARDF programs were represented by "one-man teams." Dale Hunt WB6BYU of Yamhill, Oregon, was most experienced of the four, having competed at the WCs in Hungary, served on the International Jury at the WCs in China, and organized the 1999 International Amateur Radio Union (IARU) Region 2 Championships in Portland, near his home.[4] Harley Leach KI7XF attended the China WCs and is putting on foxhunts at Montana State University in Bozeman, where he was professor of engineering for many years. Charles Scharlau NZØI represented the Piedmont area of North Carolina, where he has been promoting foxhunting since moving there from Seattle. Byon Garrabrant N6BG (**Photo E**) won foxtailing trophies in southern California in the mid-'90s and is now putting on events in Las Vegas, Nevada, following his recent move.

The remaining three stateside entrants learned ARDF by competing against champions in other countries. They were eager to teach and share their knowledge and experience. Gyuri Nagi HA3PA/KF6YKN (**Photo F**) and Csaba Tiszttarto are Hungarian citizens with USA resident status, living on the east coast while in this country. Both competed on Team USA in the WCs of 1998 and 2000. Hiroshi "Yoh" Izuta JF1RPZ/KG6CEH was a national ARDF champion for 1987 and 1993 in his native Japan. He now resides in Sunnyvale, California.

It's traditional for foreign hams to compete in national championships as visitors,

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Photo F. Gyuri Nagi HA3PA/KF6YKN, who trained in Hungary, had the best times of all in the USA-only standings.

Photo G. Marvin Johnston KE6HTS of Santa Barbara (right) put on a tri-tip beef barbecue after the practice session around Fenton Lake. Kevin Haywood N4MGB (left) of Georgia Orienteering Club captured a bronze medal three days later.

Homing In

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so the invitation went out to every country in the world with ARDF programs. Registrations came in from Australia, China, Mongolia, and Ukraine. They will be featured in an upcoming "Homing In."

Prepare for a monsoon

Early arrivers were treated to full-fledged practice sessions on both two- and eighty-meter bands, hosted by the four participants from Georgia Orienteering Club. This took place Monday, July 30, at Fenton Lake State Park, near Seven Springs. The site, at 7,740 feet above sea level, included a 25-acre lake with a dam and downstream river, surrounded by steep hills and canyon walls that went up to the 8,400 feet elevation. According to Kevin Haywood N4MGB, "Each GAOC member took off in a different direction with one of the transmitters and walked up the slope as far as our lungs would carry us."

RDF was tricky at Fenton Lake, particularly on two meters as signals echoed and scattered off the canyon walls. The steep hills made the course physically difficult, not to mention the swarms of twin-engine mosquitos that nearly carried me away. I found out later that this was a backup location for the championships in case the primary location could not be used. It's good that didn't happen!

Afterwards, everyone enjoyed a Santa Barbara style tri-tip beef barbecue supper courtesy of Marvin Johnston KE6HTS, who had been marinating the tri-tips in a cooler for three days on the way to Albuquerque (**Photo G**). Others provided salads and fixings to complete the meal.

July and August is "monsoon season" in New Mexico. Warm moist air masses come in from the south, meet the mountains, and trigger thunderstorms almost every afternoon. This day was no exception, and after a couple of brief showers during the 80-meter hunt, a real gully-washer broke out just as the barbecue ended.

Next day, most of the competitors checked into dorm rooms at the University of New Mexico (UNM) campus near downtown Albuquerque. They ate there, too, at a facility that could hardly be called a "dorm cafeteria." It was actually a full-fledged food court with a variety of hot and cold selections for every meal, serving all you want to eat.

Photo H. This whimsical AARC logo was on the front of competitor and staff T-shirts.

Photo I. April Moell (right) sounds the horn to start Charles Scharlau NZØI (left) and Scot Barth KA6UDZ on the 80m hunt. Scott drew #1 in the start lottery, putting him in the first starting position on 2m and the last on 80m.

Medal	2m winners	80m winners
M19, 4 foxes		
Gold	Jay Thompson W6JAY	Jay Thompson W6JAY
M21, 5 foxes		
Gold	Gyuri Nagi KF6YKN	Gyuri Nagi KF6YKN
Silver	Sam Smith N4MAP	Dave D'Epagnier KØQE
Bronze	Hiroshi Izuta KG6CEH	Richard Barrett KE6DKF
M40, 4 foxes		
Gold	Dale Hunt WB6BYU	Dale Hunt WB6BYU
Silver	Charles Scharlau NZØI	Scott Moore KF6IKO
Bronze	Kevin Haywood N4MGB	Charles Scharlau NZØI
M50, 4 foxes		
Gold	Dick Arnett WB4SUV	Dick Arnett WB4SUV
Silver	Larry Benko WØQE	Robert Frey WA6EZV
Bronze	Robert Frey WA6EZV	Larry Benko WØQE
M60, 3 foxes		
Gold	Harley Leach KI7XF	Harley Leach KI7XF

Table 1. USA-only standings and medal winners by category.

Wednesday, August 1, was a full day of organization, instruction, and practice on the campus. It began with the opening ceremonies, self-introductions, starting-order lottery, and a presentation from the U.S. Forest Service about its "Leave No Trace" program. Next, AARC's Event Chair, Jerry Boyd WB8WFK, thoroughly explained the rules. The most significant departure from standard IARU rules was an increase of the maximum allowable time on each hunt to three hours. This gave first-timers a greater chance of success. It also partially compensated for the high altitude and anticipated hot, dry weather.

AARC decided to use the new age/gender categories that had been proposed and debated by IARU officials in Europe and Asia, but had not yet been officially approved. The new categories for males, based on the competitors' ages on January 1, are M19 (19 and younger), M40 (40 and older), M50 (50 and older), M60 (60 and older), and M21 (intended for ages 20–39, but OK for any male). IARU also is considering four new divisions for females, but unfortunately no YLs entered these championships.

Sam Smith N4MAP of Georgia Orienteering Club then stepped up to cover all aspects of orienteering maps and forest navigation techniques, followed by Dale Hunt WB6BYU with a talk about ARDF course strategy. These presentations were primarily for the newcomers, some of whom had never participated in a full-course ARDF event and had no idea what terms like "cairn," "spur," and "reentrant" mean.

Everyone received a T-shirt with the event's unique "UFO" logo (blue for competitors, red for staff, see **Photo H**). Hydration backpacks and whistles were passed out to all, for health and safety in the forest. Competitors were told what to do in case they got hurt or lost, to summon help from the New Mexico Search and Rescue Team.

The rest of Wednesday afternoon was for training and equipment checkout, with plenty of 80m and 2m transmitters on the air throughout the UNM campus. Everyone wondered if the signal reflections and bearing aberrations caused by campus buildings were more severe than those they would encounter in the forest. After that, it was time for a hearty dinner and a good night's rest.

Where are we going?

Buses boarded promptly at 0800 Thursday. Rumors had been flying that the 2m hunt would be in the Sandia, San Pedro, or Sangre de Cristo Mountains, but instead the bus went 35 miles southeast of the city to Manzano Mountain State Park. It parked near the finish line, then AARC members drove a few hunters at a time down a narrow dirt road to the starting point, where the bus could not have gone. Scott Stevenson KC5VVB and his crew of volunteers were ready to send them off, two from different age divisions at a time, into the woods at five-minute intervals corresponding with the start of Fox #1 (MOE) transmissions (**Photo I**). While they waited, there was plenty of water and snacks.

After receiving their 11x17-inch maps just before start time, hunters discovered that the starting line was at the north end of the hunt area and the finish line was to the east. They would have to optimize their routes to find their required foxes along the way from start to finish.

IARU rules prohibit hunters from turning on their receivers until they are at the end of the start corridor, out of sight of the hunters still waiting to start. Some stayed at the end of the corridor for a full 5-fox transmission cycle, taking careful bearings on every required transmitter and plotting them on their maps. Others immediately ran off toward Fox #1.

The two-meter hunt area encompassed about 880 acres of forest, with ponderosa pine, pinon, and alligator juniper. Participants in last year's WCs in China agreed

that vegetation in Manzano Mountain Park was much less dense, making cross-country running easier, but not too easy. The weather was better this year, too. The direct sun was quite warm, but clouds increased as the hunt went on.

Altitude, which ranged from 7,250 to 7,840 feet, was the greatest running challenge for many hunters. The mosquitoes weren't out in force, but the forest floor had boulders in many places, making it important for hunters to mind their footing. The straight-line course length, from start to all five foxes and then to the finish, was just under five kilometers.

Mike Eaton K5MJE (AARC president) and another volunteer crew awaited the hunters as they ran through the corridor to the finish line. Boy Scouts at the entrance of the corridor used Family Radio Service (FRS) radios to alert the finish line staff and photographers when runners approached. The last finisher came in just as the afternoon's thunderstorm began soaking the finish shelter area. A special-event HF station (K5T) was ready, but no one wanted to operate it with lightning nearby.

The bus route was exactly the same on Friday for the 80-meter hunt, because that hunt ended in the same place. However, the start was 1.4 miles southwest of the two-meter start. The 80m hunt area was about the same size and directly south of the 2m zone. The starting line was at the western high point, so it was all downhill for the competitors if they chose the correct route.

As they picked up their 80m maps, every hunter was planning how to do better than the day before. For some, it was their first 80m hunt and they were using borrowed receivers. For others, it was an opportunity to try out their just-completed home-brew 80m ARDF sets.

Sure enough, everything went more smoothly, both for the organizers and the hunters. Almost every performance was better, even though the course length was 10 per cent longer than on two meters. The hunt was over before the afternoon rains came, except for one lost competitor that I'll tell you about next time.

The closing banquet on Friday evening, organized and presided over by Brian Mileshosky N5ZGT, included an excellent Mexican food buffet, the traditional token gift exchange, speeches of thanks, raffle prizes, lots of photos, and, of course, the medals. Afterwards, it was time to go pack the suitcases for departure by train, plane, and highway the next morning.

The winners are ...

Experience in his native Hungary and at the last two ARDF WCs paid off for Gyuri Nagi HA3PA/KF6YKN, who had the best performance by a stateside competitor on both bands. Although he could have competed in M40 division, he chose M21, requiring him to find all five foxes. His time was under 54 minutes on 2m and under 50 minutes on 80m. Close behind him on 80m was newcomer Dave D'Epagnier KØQE with less than 63 minutes. On 2m, Sam Smith N4MAP was next with less than 68 minutes. All medalists in M21 had times under 99 minutes.

In M40 division, Dale Hunt WB6BYU cruised to a gold medal by finding his required four foxes in less than 83 minutes on both bands. Newcomer Charles Scharlau NZØI had excellent under-two-hour times on both bands. But the big surprise in M40 was Scott Moore KF6IKO, who found no 2m transmitters on Thursday and then went on to take silver on 80m by finding all four in less than 86 minutes.

In M50, the gold winner both days was Dick Arnett WB4SUV. He found his 4 foxes in less than 69 minutes on 2m and 82 minutes on 80m. The 2-day battle for runner-up was between Larry Benko WØQE and Bob Frey WA6EZV. Each went home with a silver and a bronze.

The youngest competitor (Jay Thompson W6JAY) and the oldest (Harley Leach KI7XF) were in categories by themselves. (Even though he was actually 59 at the time, Harley was in M60 because "division age" is the age on your birthday in the competition year.) Each had excellent performances and each took home gold medals. Harley found his required 3 foxes in less than an hour each day. The complete list of all medalists in the USA-only standings is in **Table 1**.

That's all for this month, but there's lots more to tell about the first USA ARDF Championships. Come back next month for more stories from New Mexico. The spotlight will be on the foreign visitors, the organizers, and the informal competition among the cities. Meanwhile, start planning on-foot or mobile transmitter hunts in your home town. I welcome your RDF stories and photos, which should be sent to the postal or E-mail addresses at the beginning of this article.

Footnotes

1. Moell, Joe, "Homing In: USA Foxhunting Championships 2001 — Let's Start Planning Now," *73 Magazine*, October 2000.

2. Moell, Joe, "Homing In: A Banner Year — More to Come," *73 Magazine*, January 1999.

3. Moell, Joe, "Homing In: A New Millennium for Foxhunting," *73 Magazine*, January 2001.

4. Moell, Joe, "Homing In: City of Roses — and Foxes," *73 Magazine*, October 1999.

Microwind to the Rescue!

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on the list. All three of these suppliers can be found on the Web, or you can order by phone. The contact information for these suppliers is:

DIGI-KEY
1-800-344-4539
[http://www.digikey.com]

CIRCUIT SPECIALISTS
1-800-528-1417
[http://www.web-tronics.com/]

RADIOSHACK.COM
1-800-442-7221
[http://www.radioshack.com]

While there's no reason why the circuits could not be built on small pieces of perfboard, the printed circuit boards make it simpler, avoiding any hand-wiring. I can provide a set of two bare circuit boards, etched and drilled, for $5 plus $1 for postage. Send check or money orders to:

THOMAS MILLER
216 East 10th Street
Ashland OH 44805

If there is enough interest, I will consider offering a kit of circuit boards, electronic components and the blade adapter. Keep an eye on my Web site [http://www.bioelectrifier.com] for updates and additional information on this and many other projects.

VOM Primer

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read AC volts requires converting the AC into DC and then reading the DC in the usual way. A half-wave rectifier is used to convert the AC to DC. Half wave rectification produces a DC (average) voltage that is 0.3183 x E_{peak}. The meter face is marked to indicate the RMS voltage, which is 0.7071 x E_{peak}. The AC meter reads average and indicates RMS. Measuring complex wave shapes can lead to confusing readings unless the shape is known. If the AC frequency is very low, the meter will follow the voltage or current and not indicate the average.

Most meters are calibrated with 60 Hz. At low voltages, the forward voltage drop across the rectifier is significant, and a separate low AC voltage scale added to the meter.

Frequencies above high audio are not usually measured with a VOM because the capacitance of the meter's circuits is lossy or unpredictable and the equivalent multiplier is unknown.

To summarize the limitations of a VOM: The ideal current meter has zero resistance and drops no voltage. A real-world current meter has some resistance and drops a little voltage, usually on the order of 25 mV or 50 mV. The ideal voltmeter has an infinite resistance and does not load the circuit. A real-world voltmeter loads the circuit under test. The loading is a function of the voltage scale used and the sensitivity of the meter. The loading provided by a voltmeter is given as ohms per volt.

The AC voltmeter function reads the average of the AC and indicates RMS. The AC voltage is assumed to be a 60 Hz sinusoid. Voltages of audio frequencies can be read with unspecified accuracy. The circuit under test is still loaded by the meter.

The VOM is a most useful instrument. It is rugged but not bulletproof: They can be abused to the detriment of the meter. In fact, the VOM is probably the most used instrument on the bench, and no bench should be without one — despite its limitations.

Ye Olde Fishpole Vertical

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the coax is connected back on the rig.

If you don't have an antenna analyzer, you will have to go through the purgatory of reducing power and checking and rechecking the SWR.

I also obtained good results by using the metal frame of a door, and an air conditioner metal frame mount.

There will definitely be variations to the tuning, depending on the inherent density values surrounding your area of installation. In some cases a larger value capacitor may be required. My capacitor value turned out to be 125Pf under a variety of different applications. If the installation is to be permanent, then measure the cap's value and replace with a good fixed mica capacitor for a smaller foot print. Follow the simple rules in resonating an antenna, and I am sure that it will work quite as well for you as it has for me.

I am sure that this antenna will give you more ideas for other ventures, and I hope to be reading about them.

Although this antenna has been tested at 40 watts. I recommend that it be used for QRP only.

I used approximately 25 feet of mini RG-8X coax cable for my installations, but RG-58 could also be used. Although it has more capacitance per foot, I am sure that you could get it to resonate. Experiment! The MFJ SWR analyzer would be a great assist for the initial setup. Have fun! Get outdoors with your favorite hobby!

The Builder's Dozen

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11. Vernier gear drives can be created from VHS tape player deck gearing. Use heavy perfboard as a sandwich to hold the gearing. The plastic spacers described above can be cut to form the necessary corner spacers and bearings. While not a tight professional unit, it has been in service for several years now and works as it did when new.

12. Storage boxes, the ones sold at the craft store for storage of thread on small paper squares, make ideal units for keeping resistors, caps, etc., sorted and ready for use. They're about 8" by 12" and are divided into compartments for easy sorting of parts. The price on these is about $2, and sometimes they can be found on sale for half that. Mark the outside of the box with the contents for easy identification.

And there you have a "Builder's Dozen" of helpful hints for a more successful project. Keep building! There's no end to the pride and sense of accomplishment achieved when you create your own projects!

Above & Beyond

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configurations, were obtained; these will be made available to other amateurs. We make these devices available for those who cannot find units at their own local swap meets. The beige LNB, tested and ready to convert, is available for $20 postpaid from the author. Please direct any question on this and any other items to Chuck WB6IGP at [clhough@pacbell.net].

QRP

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either open up or short circuit. Lucky for us, they're just cheap bipolar transistors.

Opening the SA-5010 is easy: There are four screws holding the bottom plate on. The top and bottom halves come apart. On the bottom plate, a 7805 regulator is mounted with a connecting cable leading to the main PC board. This cable must be unplugged before the two halves can come apart. Once apart, there is one more cable that needs to be messed with. That's the one that goes to the keypad. There is another smaller PC board that holds the LED. This guy always seems to get in the way.

The keying transistors are mounted on the top right-hand side of the PC board. There you will also find the bridge rectifier made up of four diodes. These diodes provide the SA-5010 with the ability to operate on either AC or DC power. The SA-5010 is not polarity-sensitive either. These diodes will always select the proper polarity and send it the necessary circuits.

Putting the SA-5010 back together requires several more hands than most of us

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Jim Gray II
210 E. Chateau Circle
Payson AZ 85541
[akdhc2pilot@yahoo.com]

DXers, Rejoice!

December should offer DXers some of the best conditions of the year, as daytime signal absorption and atmospheric noise both decline to seasonal minimums in the northern hemisphere. Activity on the sun is also expected to moderate somewhat, leaving plenty of opportunity to exchange "season's greetings" with stations worldwide.

As shown on the calendar, eighteen days should bring us at least Fair (F) propagation conditions — the best days being the 11th to 13th and 25th to 27th, when solar activity is projected to be very low. Of course, there will be some disturbed periods, and the whole week from the 2nd through 8th looks particularly dismal. Other "critical" dates are the 14th, 17th, 19th, 23rd, 28th, and 31st, so expect moderate flares, coronal mass ejections (CMEs), and associated high flux values on those days. As always, geomagnetic effects may follow some eruptions within 72 hours, so be sure to monitor WWV for any developments.

Last month, I mentioned that we would look at the methods and pitfalls of propagation forecasting. Unfortunately, due to various constraints, this discussion will have to wait until a future issue. However, to set you to pondering the first subject of my intended discourse, let me pose a question: What does the latitude of your station have to do with the propagation and quality of the HF signals that you send or receive?

Band-by-Band Summary

10–12 Meters

Worldwide openings will occur from sunrise to just after sunset. Europe, the Middle East, and Africa will be best before noon. Central and South America should remain open from midmorning through late afternoon, with some noontime fading. The Pacific and Asia should open from noon through early evening. Expect skip to be 1,000–2,000 miles.

December 2001						
SUN	MON	TUE	WED	THU	FRI	SAT
						1 G
2 F-P	3 P	4 P	5 F-P	6 F	7 F-P	8 F
9 F-G	10 F-G	11 G	12 VG	13 VG	14 P	15 F-G
16 F-G	17 F-P	18 F	19 F-P	20 F-G	21 F-G	22 G
23 F-P	24 F	25 G	26 VG	27 VG	28 F-P	29 F
30 F-G						

EASTERN UNITED STATES TO:												
GMT	00	02	04	06	08	10	12	14	16	18	20	22
Central America	15 (40)	20 (40)	20 (40)	(40)	(40)	(20-40)	(15) 20	10-20	10 (20)	10-17	10 (20)	(10) 20
South America	(15) 20	20 (40)	20 (40)	20 (40)	x	x	(15-20)	x	(10)	10 (15)	10 (20)	(10) 20
Western Europe	40	40	40	40	(40)	x	(10-20)	10 (20)	(10) 20	(15-20)	(20)	(20-40)
Southern Africa	(20-40)	(40)	x	x	x	x	x	(10-12)	10 (17)	(12) 17	(15-20)	20
Eastern Europe	(40)	(40)	x	x	(20)	x	(10-20)	(10) 20	(20)	x	x	x
Middle East	(40)	(40)	x	x	x	x	(10)	(10-15)	15 (20)	20	(20)	(20)
India/ Pakistan	x	x	x	x	x	x	x	(15-20)	x	x	x	(20)
Far East/ Japan	(15) 20	20	(20)	(20)	x	x	(20)	x	x	x	x	(10-20)
Southeast Asia	(15-20)	x	x	x	x	x	x	(10-20)	(10-15)	x	x	x
Australia	(10-17)	(15-20)	x	x	(20)	(30-40)	(20-40)	(10) 20	(10-20)	x	(20)	(10-15)
Alaska	15-17	20-30	x	x	x	20-30	20-30	15-17	15-17	x	x	15-17
Hawaii	(10) 15	(20)	20	(20)	20 (40)	40	(20-40)	(20)	(15-20)	x	(10)	10 (15)
Western USA	(10) 40	(15) 40	20-40	(20) 40	40	40	40	(20-40)	(10-20)	10-20	10-20	10-20
CENTRAL UNITED STATES TO:												
Central America	(15) 20	20 (40)	(20) 40	(20) 40	(20) 40	40	(40)	(10) 20	10-20	10-15	10 (20)	15-20
South America	(15) 20	20	20 (40)	20 (40)	(20)	x	x	x	(10)	10	10(20)	(10) 20
Western Europe	(40)	40	40	(40)	x	x	(20)	(15) 20	(10) 15	(15) 20	(20)	x
Southern Africa	20	(20)	x	x	x	x	x	x	(10-15)	(10) 15	15 (20)	20
Eastern Europe	x	(40)	x	x	x	x	x	(10) 20	(10-20)	x	x	x
Middle East	x	(40)	(20)	(20)	x	x	x	(10-15)	(10-15)	(20)	20	(20)
India/ Pakistan	x	(15)	x	x	x	x	(20)	x	(15)	x	x	x
Far East/ Japan	x	x	(20)	20	(20-40)	(40)	(20)	20	(15-20)	x	15	(15)
Southeast Asia	x	x	x	x	(20)	(20)	20	(15-20)	(15)	x	(15)	x
Australia	(10) 15	15	(15-20)	20	20 (40)	20-40	20 (40)	(20)	x	x	x	(10-15)
Alaska	15-17	15-17	x	x	x	(40)	(40)	20	20	x	x	x
Hawaii	(10) 15	(15-20)	20	20	(40)	(20-40)	20 (40)	x	(15)	(15)	(15)	(10) 15
WESTERN UNITED STATES TO:												
Central America	(20-40)	40	40	40	(40)	x	(20)	(10) 20	10 (20)	10 (20)	(10) 20	(15) 20
South America	17 (40)	(20)	x	x	x	x	x	(15)	12 (20)	10-20	10-20	12 (40)
Western Europe	x	x	(40)	(20)	(20)	x	(20)	(10-20)	(10) 20	(20)	x	x
Southern Africa	(20)	x	x	x	x	x	x	x	(10)	(15)	15 (20)	(15) 20
Eastern Europe	x	x	x	x	x	x	x	x	x	x	x	x
Middle East	(20)	(40)	(20)	20	20	(20)	x	(15)	(10) 15	(10-15)	(20)	(20)
India/ Pakistan	(15-20)	x	x	x	x	x	x	(20)	x	x	x	x
Far East/ Japan	(10) 20	(15-20)	x	x	(40)	40	(40)	x	x	x	(10-20)	10-20
Southeast Asia	(15)	(20)	x	x	x	x	x	(20)	(15) 20	(20)	(10-15)	10-15
Australia	(10-15)	(15-20)	x	x	x	(20-40)	(20-40)	20	(15-20)	15	(10-15)	10
Alaska	10-15	x	x	20-30	20-30	20-30	20-40	x	20	15	x	15-17
Hawaii	(15) 20	(15) 20	20	(20)	(40)	40	(20-40)	(15) 20	15 (20)	(10-15)	10 (15)	(10) 15
Eastern USA	(10) 40	(15) 40	20-40	(20) 40	40	40	(20-40)	(10-20)	10-20	10-20	10-20	10-20

Table 1. *Band, time, country chart. Plain numerals indicate bands which should be workable on Fair to Good (F-G) and Good (G) days. Numbers in parentheses indicate bands usually workable on Good (G) days only. Dual numbers indicate that the intervening bands should also be usable. When one number appears in parentheses, that end of the range will probably be open on Good (G) days only.*

Listings are free of charge as space permits. Please send us your Calendar Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the March issue, we should receive it by December 31. Provide a clear, concise summary of the essential details about your Calendar Event.

JAN 19

ST. JOSEPH, MO The 12th annual Northwest Missouri Winter Hamfest, co-sponsored by the Missouri Valley ARC and the Ray-Clay ARC, will be held 8 a.m.–3 p.m. at the Ramada Inn in St. Joseph MO. The motel is located at i-29 and Frederick Ave. (Exit 47 on I-29). Special room rates are offered for hamfest participants. Talk-in on 146.85 and 444.925. VE exams, major exhibitors and flea market all indoors. Free parking. Advance tickets $2 each or 3 for $5; at the door, $3 each or 2 for $5. Pre-registration requests received after January 6th will be held at the door. Swap tables $10 each for the first two tables. Commercial exhibitors are welcome, write for details: *Northwest Missouri Winter Hamfest, c/o Neal WBØHNO or Carlene KAØIKS Makawski, 3704 Meadowoak Ln., St. Joseph MO 64503.* E-mail *[nem3238@ccp.com]*; or tel. *(816) 279-3406.*

JAN 20

HAZEL PARK, MI The Hazel Park ARC's 36th Annual Swap & Shop will be held at the Hazel Park High School, 23400 Hughes St., Hazel Park MI, 8 a.m.–2 p.m. General admission is $5 in advance or at the door. Plenty of free parking. Tables $14. Reservations for tables must be received with a check. No reservations by phone. Talk-in on 146.64(-), the DART rptr. For info about the swap, tickets, or table reservations, mail to *HPARC, P.O. Box 368, Hazel Park MI 48030.*

SPECIAL EVENTS, ETC.

DEC 14, 15

BETHLEHEM, IN The Clark County ARC will operate W9WWI 1500Z December 14th–2200Z December 15th, in celebration of the Christmas season. Operation will be on General 75, 40, and 20 meters. QSL with an SASE for a certificate to *CCARC, 1805 E. 8th St., Jeffersonville IN 47130.*

15–17 Meters

Openings can be found from sunrise to mid-evening on good days. The best times will generally be a bit after the peaks for 10 and 12 meters, but the bands should remain active until about 9 p.m. local. Skip will be shorter, though, at only 1,000 miles or so.

20 Meters

Around-the-clock activity can be found here. Expect peaks just after sunrise. From late afternoon to early evening, and just before midnight. Central and South America should be workable at all hours except sunrise. Skip will average 500–1,000 miles during the day and 1,500–2,000 miles at night.

30–40 Meters

These bands will usually be open between 7 p.m. and 7 a.m. local time. Europe and the Near East will be best before midnight while the Far East and the Pacific will be best after 12 a.m. The Americas should be open all night long. Expect short-skip to be from 1,000–2,000 miles.

80–160 Meters

December is a good month for these bands, given the long northern nights and few tropical disturbances. The greatest storm activity will occur in the South Pacific, so most static will occur on paths across that area. The strongest signals are likely to be from Europe, Africa, and the Middle East between sunset and midnight. Short-skip will typically fall between 1,500 and 2,000 miles. Until next time, 73 and Happy Holidays! Jim Gray, [akdhc2 pilot@yahoo.com].

QRP

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are equipped with. Just plug the various circuit boards back into their jacks. Then squeeze the two halves together and, with a bit of luck, it will all fit. I've found that it takes about a half a dozen tries before you get everything back together like it should be.

HW-8 modifications

We're still looking for more modifications to the Heathkit QRP series. No matter how simple or complex, if you have a modification or a fix for a problem with any of the radios, please pass it on to me.

And, by the time this gets to print, I'll have uploaded PC board layout and circuits for the HD-1410 keyer on my Web site. Check them out at: [http://www.theheathkitshop.com].

THE DIGITAL PORT

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development wheels to slow to a crawl. But the work keeps going and, if anything, the tempo increases. It takes a mighty amount of brainpower to continue to push forward on these diverse fronts as much as Dave does.

Ham bands are busy

As this is being written, it is one of the hottest August months I can recall. It hit the hundred mark just 30 miles down the road from here yesterday. I like to stay inside during that kind of weather. And I get lazy and like to play with the radio.

Usually, this time of year seems to lack for radio activity a bunch of the time, but this year is giving plenty of action. I am seeing plenty of foreign callsigns on the monitor. Sometimes they are not direct, but at least they are being worked by someone in a better spot for the propagation.

Other times, these signals are dropping in here just as well as they might in the early parts of Spring. I think some of this is because the popularity of the digital modes is keeping hams involved, and when that happens someone is on the air at the right time to take advantage of unpredictable openings.

What I am saying concerns activity. It

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The Digital Port

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doesn't have to be digital, or a certain band or mode. What matters is that there are enough stations on the air and listening to make some of those thrilling contacts to remote regions and faraway places.

That being said, we can get back to the fact that digital modes are causing a real stir in the ham ranks and a great percentage of the fun is to be had because of the new modes we discuss here. Keep it up, guys!

One final note. I just received my first Digital Port–related E-mail due to an article in the September issue. Now I know that the new E-mail address is out there and working. Always glad to hear from you folks in ham radio land.

If you have questions or comments about this column, E-mail me at [KB7NO @worldnet.att.net]. I will gladly share what I know or find a resource for you. For now, 73, Jack KB7NO.

On the Go

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with proper preparation? Also, don't take offense if people confuse ham radio with CB. Sure, there's a world of difference, but to many people, "Ten-four good buddy" doesn't sound significantly different than "Roger and thanks for the Cue-so."

Rule Number Three: Focus on the community that encompasses ham radio and how supportive it is. There are classes to help people prepare for their first exam or an upgrade. If you prefer to study alone, there are "Elmers" who will be happy to answer a question or explain a concept. Maybe someone would enjoy being part of the Field Day group or the hamfest committee. Get two hams together at a restaurant on a regular basis and soon it'll be a small crowd enjoying the camaraderie.

Rule Number Four: Let people know how much ham radio helps out the neighborhood and the community. When people think of a disaster, they may automatically think of such organizations as the Red Cross or Salvation Army. These agencies depend upon hams to help them in their relief effort. If you live in an area that is subject to bad weather, you know how important SkyWarn is to the weather service. Hams' role in public service covers everything from the Christmas Parade to support at college football games.

Rule Number Five: It's a hobby. It's supposed to be fun. Most of us want to share the fun with others we like, so focus on how much fun you've had with the hobby. Focus on the fun you've had recently, not back in the good old days.

Now, don't just sit there: Go talk to somebody about how great a hobby this is! If you help someone become a ham, let me know. If you've been thinking of becoming a ham and this helps make up your mind, let me know that. I can't wait to hear from you.

QRX

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increased by about 20,000 since April 15th of 2000. At the same time, the total number of combined Technician and Technician Plus operators has declined. Also, the number of Novice class license holders has been deteriorating steadily since 1991, when the No Code Technician became the entry level license of choice. There were 95,000 Novice license holders on February 1, 1991. Maia says that today there are only 42,000, a decrease of 60 percent.

On the surface, it would appear that there is a significant net loss of hams who held telegraphy skills, but Maia says that this too may be inaccurate, since many Technicians do indeed have their 5 wpm Morse rating, as mentioned above. But they are now lumped in an FCC database that uses the term Technician to describe them all. In fact, this alone renders the term No Code Tech as being obsolete.

And here's the real kicker. Reducing the Morse testing speed to 5 wpm has not accounted for any significant numbers of new applicants for ham radio licenses. What it has done is to motivate existing hams to upgrade to get new privileges, but that's about it. The bottom line is that the number of amateurs in each license class has merely been rearranged.

Maia's conclusion? Amateur Radio is not growing in relation to the growth of the nation's population. He says that reduction of the Morse speed to 5 wpm and fewer license classes has had no discernible impact on growth in the United States Amateur Radio Service. Or at least none so far.

Thanks to David Black KB4KCH and the W5YI Report, *via* Newsline, *Bill Pasternak WA6ITF, editor.*

Never say die

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the position of deputy administrator at the EPA? Linda, now an executive with Monsanto, had worked for the EPA for 10 years before heading Monsanto's Washington lobbying office. Back at the EPA in a top position, she'll be making biotech food decisions which can affect us all.

Anyway, here are some quotes from the vaccine article.

"The grandson of Congressman Daniel Burton, of Indiana, was vaccinated for nine different diseases in one day. Before the vaccines he had been a healthy child. Now he suffers from autism."

"Autism has an onset before 30 months of age. There has been a dramatic increase in this (psychiatric) disorder throughout the United States during the last six years. Statistics in Ohio show a 6,822 percent increase of this disease over that period of time. California has experienced a similar explosion in the number of new cases of autistic children. Nationally, we have had a 26 percent increase per year."

"Mercury is used as a preservative in many vaccines. With those nine vaccines, Congressman Burton's grandson was injected with 41 times the considered safe level of mercury in one day. Mercury poisoning alone has been linked to autism, other learning difficulties, and emotional disorders. Children under 2 years of age do not produce enough bile to remove the mercury, so it deposits in their brains, the kidneys, and in other vital organs. For many persons this heavy metal is never eliminated from the body."

Heard enough?

Wise Up!

Here are some of my books which can change your life (if you'll let 'em). If the idea of being healthy, wealthy and wise interests you, start reading. Yes, you can be all that, but only when you know the secrets which I've spent a lifetime uncovering.

......Wayne

The Secret Guide to Health: Yes, there really is a secret to regaining your health and adding 30 to 60 years of healthy living to your life. The answer is simple, but it means making some serious lifestyle changes. Will you be skiing the slopes of Aspen with me when you're 90 or doddering around a nursing home? Or pushing up daisies? No, I'm not selling any health products, but I can help you cure yourself of cancer, heart trouble, or any other illness. Get this new, 2001 expanded edition (156p). $10 (#05)

The Secret Guide to Wealth: Just as with health, you'll find that you have been brainwashed by "the system" into a pattern of life that will keep you from ever making much money and having the freedom to travel and do what you want. I explain how anyone can get a dream job with no college, no résumé, and even without any experience. I explain how you can get someone to happily pay you to learn what you need to know to start your own business. $5 (#03)

The Secret Guide to Wisdom: This is a review of around a hundred books that will boggle your mind and help you change your life. No, I don't sell these books. They're on a wide range of subjects and will help to make you a very interesting person. Wait'll you see some of the gems you've missed reading. You'll have plenty of fascinating stuff to talk about on the air. $5 (#02)

The Bioelectrifier Handbook: This explains how to build or buy ($155) a little electrical gadget that can help clean your blood of any virus, microbe, parasite, fungus or yeast. The process was discovered by scientists at the Albert Einstein College of Medicine, quickly patented, and hushed up. It's curing AIDS, hepatitis C, and a bunch of other serious illnesses. It's working miracles! The circuit can be built for under $20 from the instructions in the book. $10 (#01)

My WWII Submarine Adventures: Yes, I spent from 1943-1945 on a submarine, right in the middle of the war with Japan. We almost got sunk several times, and twice I was in the right place at the right time to save the boat. What's it really like to be depth charged? And what's the daily life aboard a submarine like? How about the Amelia Earhart inside story? If you're near Mobile, please visit the Drum. $5 (#10)

Wayne's Caribbean Adventures: My super budget travel stories – where I visit the hams and scuba dive most of the islands of the Caribbean. You'll love the special Liat fare which let me visit 11 countries in 21 days, diving all but one of the islands, Guadeloupe, where the hams kept me too busy with parties. $5 (#12)

Cold Fusion Overview: This is both a brief history of cold fusion, which I predict will be one of the largest industries in the world in the 21st century, plus a simple explanation of how and why it works. This new field is going to generate a whole new bunch of billionaires, just as the personal computer industry did. $5 (#20)

Cold Fusion Journal: They laughed when I predicted the PC industry growth in 1975. PCs are now the third largest industry in the world. The cold fusion ground floor is still wide open, but then that might mean giving up watching ball games. Sample: $10 (#22)

Julian Schwinger: A Nobel laureate's talk about cold fusion—confirming its validity. $2 (#24)

Dowsing. Yes, dowsing really does work. I explain how and why it works, opening a huge new area for scientific research with profound effects for humanity. $2 (#84)

Improving State Government: Here are 24 ways that state governments can cut expenses enormously, while providing far better service. I explain how any government bureau or department can be gotten to cut it's expenses by at least 50% in three years and do it cooperatively and enthusiastically. I explain how, by applying a new technology, the state can make it possible to provide all needed services without having to levy *any* taxes at all! Read the book, run for your legislature, and let's get busy making this country work like its founders wanted it to. Don't leave this for "someone else" to do. $5 (#30)

Mankind's Extinction Predictions: If any one of the experts who have written books predicting a soon-to-come catastrophe which will virtually wipe most of us out are right, we're in trouble. I explain the various disaster scenarios, like Nostradamus, who says the poles will soon shift (as they have several times in the past), wiping out 97% of mankind. Okay, so he's made a long string of past lucky guesses. The worst part of these predictions is the accuracy record of some of the experts – like Hapgood, Einstein, Snow, Noone, Felix, Strieber. $5 (#31)

Moondoggle: After reading René's book, *NASA Mooned America*, I read everything I could find on our Moon landings. I watched the NASA videos, looked carefully at the photos, read the astronaut's biographies, and talked with readers who worked for NASA. This book cites 45 good reasons I believe the whole Apollo program had to have been faked. $5 (#32)

Classical Music Guide: A list of 100 CDs which will provide you with an outstanding collection of the finest classical music ever written. This is what you need to help you reduce stress. Classical music also raises youngster's IQs, helps plants grow faster, and will make you healthier. Just wait'll you hear some of Gotschalk's fabulous music! $5 (#33)

The Radar Coverup: Is police radar dangerous? Ross Adey K6UI, a world authority, confirms the dangers of radio and magnetic fields, including our HTs and cell phones. $3 (#34)

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Reprints of My Editorials from *73*. Very few things in this world are as we've been taught, and as they appear. I blow the whistle on the scams around us, such as the health care, our school system,. our money, the drug war, a college education, sugar, the food giants, our unhealthy food, fluorides, EMFs, NutraSweet, etc.

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IX

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The *73* Flea Market, Barter 'n' Buy, costs you peanuts (almost) — comes to 35 cents a word for individual (noncommercial!) ads and $1.00 a word for commercial ads. Don't plan on telling a long story. Use abbreviations, cram it in. But be honest. There are plenty of hams who love to fix things, so if it doesn't work, say so.

Make your list, count the words, including your call, address and phone number. Include a check or your credit card number and expiration. If you're placing a commercial ad, include an additional phone number, separate from your ad.

This is a monthly magazine, not a daily newspaper, so figure a couple months before the action starts; then be prepared. If you get too many calls, you priced it low. If you don't get many calls, too high.

So get busy. Blow the dust off, check everything out, make sure it still works right and maybe you can help make a ham newcomer or retired old timer happy with that rig you're not using now. Or you might get busy on your computer and put together a list of small gear/parts to send to those interested?

Send your ads and payment to: *73 Magazine*, Barter 'n' Buy, 70 Hancock Rd., Peterborough NH 03458 and get set for the phone calls. The deadline for the February 2002 classified ad section is December 10, 2001.

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